



NEWS

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The Africanized Honeybee: Texas Public Health Concerns

TEXAS STATE DOCUMENTS COLLECTION

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THE AFRICANIZED HONEYBEE: TEXAS PUBLIC HEALTH CONCERNS

African honeybees (Apis mellifera scutellata) were brought to Brazil in 1956 by a Brazilian geneticist who intended to breed them with European varieties. His goal was to improve honey production by creating a bee well-suited to hot climates. The experimental colonies, accidentally released before the studies were completed, proved to be highly defensive and more easily provoked than the gentler European honeybees. Since their release, the Africanized honeybees have slowly migrated northward and are expected to reach the Texas/US border within the next one to two years (Figure 1).

From a public health perspective, the Africanized honeybee presents a potential, though minimal, health threat to humans through the following two mechanisms: 1) a direct toxic effect through envenomation resulting from multiple stings and 2) a severe allergic or anaphylactic response to one or more bee stings in a sensitized individual.

In the US, few if any deaths result from direct toxic effects of honeybee venom. Most investigators do not feel that the toxicity or quantity of venom delivered via an Africanized honeybee sting will differ significantly from that of the European bee, although the Africanized honeybee is expected to demonstrate more aggressive behavior than the European (domestic) honeybee. In a non-sensitized individual, 500-2,000 stings are required to produce a potentially lethal outcome.

Honeybee venom contains a variety of proteins which comprise about 50% by weight of the venom. Among these proteins are:

1. Mellitin - This is the major proteinaceous component of bee venom which is responsible for pain, direct lytic action on red blood cells through a detergent-like action, and potentiation of enzymes (primarily phospholipase A) present in the venom. Although mellitin is the primary protein component by weight in bee venom, it is not very allergenic.
2. Phospholipase A - This enzyme is the primary allergen present in bee venom, comprising about 4-6% of the total weight. Approximately 90% of persons allergic to bee stings exhibit IgE antibodies to phospholipase A.

3. Hyaluronidase - This enzyme acts as a spreading factor by breaking down hyaluronic acid in connective tissue. It is considered a major allergen. More than half of all persons allergic to bee venom exhibit IgE reactivity to hyaluronidase.

4. Other components include: apamin, mast-cell degranulating peptide, secapin, acid phosphatase, tertiapin, histamine, and dopamine and noradrenalin (catecholamines).

Each year in the US, approximately 40 persons are reported to have died as a result of one or more *Hymenoptera* stings. The vast majority of these fatal outcomes are described by most investigators as hypersensitivity reactions. However, at least one investigator, Howard S. Rubenstein, MD, from the Harvard University Allergy Clinic, argues that only about 12-15% of these deaths can be attributed to anaphylaxis or a severe allergic reaction.¹ He asserts that multiple underlying factors may play a role in *Hymenoptera* sting-associated deaths (eg, the degree of atherosclerosis, fright reactions, pulmonary edema), citing findings from two autopsy series on fatalities from insect stings. In these two series, only 12% of those who died had autopsy findings consistent with anaphylaxis. The controversy over what percentage of bee-sting deaths to attribute to anaphylaxis highlights how difficult it is to scientifically assess a health problem (bee-sting fatalities) which occurs at such an extremely low rate among a large population of exposed persons (millions of persons are stung each year in the US by bees and other *Hymenoptera*).

In spite of Doctor Rubenstein's argument de-emphasizing anaphylaxis and severe allergic reactions as the primary cause of death from bee stings, other investigators and common sense (along with biologic models) still indicate that IgE-mediated hypersensitivity reactions play an important role in bee-sting associated fatalities.^{2,3}

One researcher, HRG Riches separates allergic reactions to bee stings into two categories:²

1. Type I IgE-mediated hypersensitivity reactions, which he further subdivides into:
 - a. large local reactions
 - b. systemic reactions
 - c. anaphylaxis, with death resulting from circulatory collapse or respiratory obstruction
2. Type III IgG-mediated hypersensitivity reactions, which he subdivides into:
 - a. arthus (precipitin) type
 - b. serum-sickness type

The type III IgG-mediated reactions are not life threatening. Thus, prevention of bee-sting fatalities more often involves management of severe type I IgE-mediated reactions to bee stings. Such IgE sensitivity may be identified through clinical history (severe wheezing, syncope, circulatory collapse and shock, etc.), skin testing, or radioallergosorbent testing (RAST). (The reader is referred to both Doctors Hoffman and Riches' articles for excellent reviews of this subject.)

RECOMMENDATIONS

I. General public who may be at risk of serious reaction to Africanized honeybee stings

It is estimated that from 0.4-0.8%, or approximately 920,000 - 1,840,000 persons in the general US population have a history of systemic allergic reactions to bee stings.¹ Though frequent, these reactions are generally self-limiting. Even assuming, however, that all of the annual deaths attributed to bee stings are the result of hypersensitivity reactions (some argue about half actually are), the annual risk of a fatal bee sting in this population would be between one in 23,000-46,000. (For comparison, the annual risk of sustaining a fatal vehicle injury is one in 4,600 or ten times higher.)

Given this situation, the following recommendations are made for the general public:

1. Those persons with a documented history of severe reactions to bee stings, or who have skin test or RAST documentation of IgE-mediated *Hymenoptera* venom allergy, should consult a knowledgeable specialist concerning immunotherapy. [Current information supports a 2- to 6-month treatment program which uses gradually increasing doses (up to 100 g) of each venom used.]
 2. Skin or RAST testing and immunotherapy are not indicated for persons in the general public who do not have a history of a severe systemic reaction to bee or other *Hymenoptera* stings.
- ### II. Special cases -- EMS, police, firemen, and other persons who will be involved in activities where they may be exposed to Africanized honeybee stings
1. Those public servants and private workers involved in such activities as beekeeping or pest control should be skin or RAST tested before knowingly exposing themselves to Africanized honeybees.
 2. Those who are skin-test or RAST positive for IgE-mediated sensitivity to bee stings should not be employed in situations where they might place themselves at risk of exposure to Africanized honeybees. Once identified, such individuals should consult a specialist concerning the need for immunotherapy. However, even if a successful course of immunotherapy is completed, such persons **should not** be placed in situations of increased risk for exposure to Africanized honeybee stings.

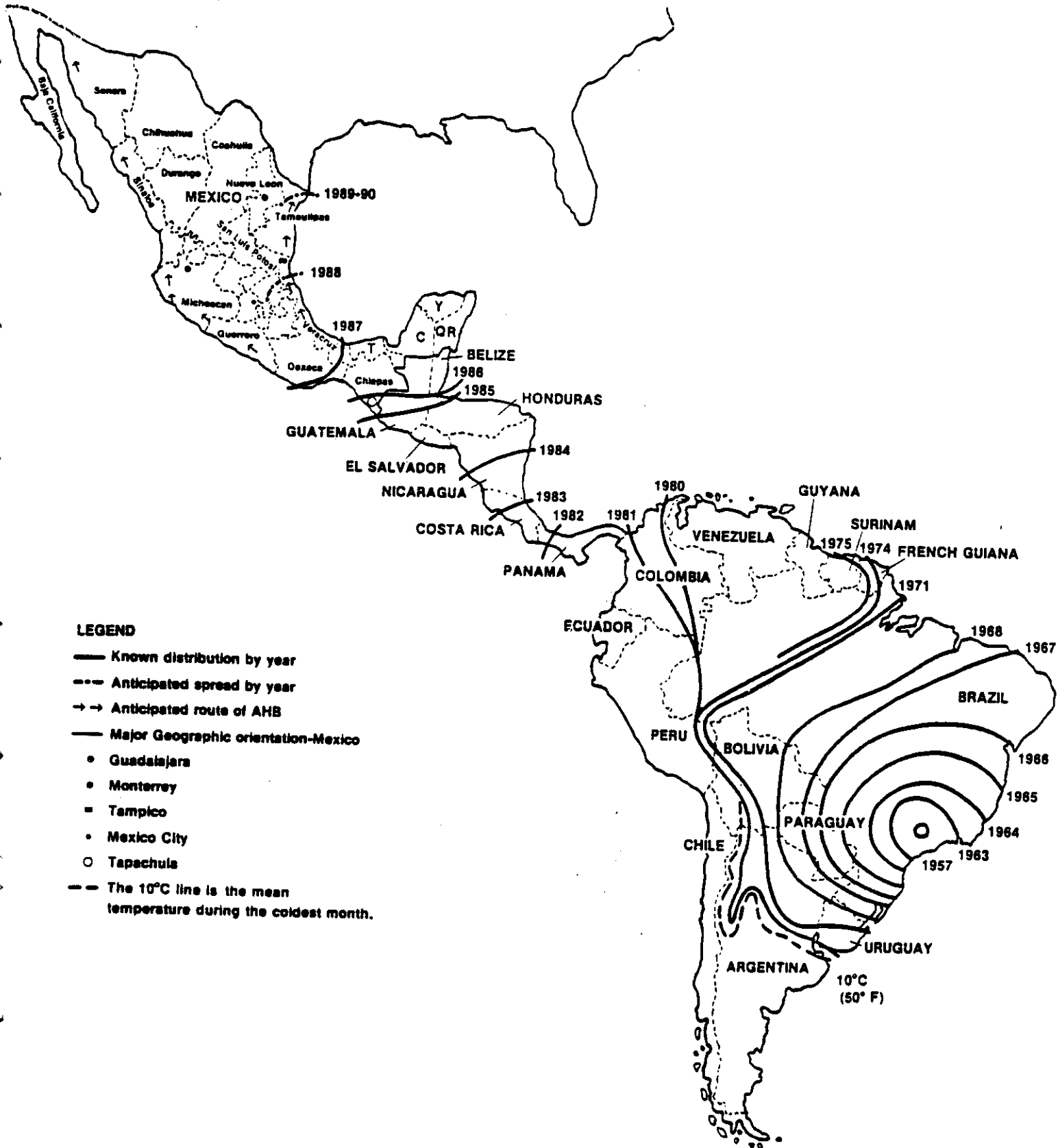
III. Treatment of life-threatening reactions to Africanized honeybee stings

The vast majority of life-threatening reactions are expected to remain those of IgE-mediated hypersensitivity. Treatment of these severe type I reactions is accomplished following standard protocols for reactions of this type, including epinephrine and life-system supportive care.

Depending upon the number of cases of life-threatening direct venom toxicity, development of Africanized honeybee venom-specific anti-

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Figure 1. Distribution of the Africanized honey bee in the Americas



venin may need to be considered, although there are no indications that this option will be warranted. Most life-threatening direct venom toxicity reactions can be managed with supportive care.

IV. No special training of EMS or medical personnel will be required, since management of reactions of the type seen with Africanized honeybee stings is already part of their standard medical training.

CONCLUSION

There are no completely reliable figures available regarding the impact of Africanized honeybees on human morbidity and/or mortality in the countries they have invaded since their accidental release in Brazil in 1957. Neither the World Health Organization, nor the Pan American Health Organization, nor the Centers for Disease Control, nor the public health authorities of any of the countries involved have seen fit to require the reporting of bee-sting data. In view of the extensive news media and movie publicity which has been afforded "killer bees," it seems highly

improbable that all these public health officials could be unaware of the bees. We can only conclude, therefore, that Africanized honeybees are not a major public health problem in the countries where they are presently established, and that they are highly unlikely to become a major public health problem in Texas.

Editorial Note: The best public health response to fears of an invasion of "killer bees" is public education. Children and adults should be informed of the importance of bees and how to avoid provoking them.

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