

What's Eating You? Native and Imported Fire Ants

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Approximately 1% of children and 3% of adults are allergic to stings of Hymenoptera insects (eg, wasps, bees, ants) and at least 40 individuals die each year in the United States from adverse reactions, many with no history of a sting reaction.¹ In the United States, reactions to Hymenoptera stings most commonly are caused by yellow jackets and honeybees; followed by fire ants and paper wasps; and less frequently harvester ants, hornets, bumblebees, and sweat bees.² Ants generally are not appreciated as causes of anaphylaxis, but a growing number of species in the United States have been reported to cause this medical emergency (Table).

Stinging ants cause major problems in certain regions of the country (namely, areas of the southeastern United States) that are infested with red imported fire ants (*Solenopsis invicta*) (Figure 1). One study determined that in a suburb of New Orleans, Louisiana, 58% of the residents per year were stung by red imported fire ants,⁴ and Caplan et al⁵ reported that 17% (34/200) of a study population in Augusta, Georgia, was sensitized to their venom. There are fewer reported native fire ant stings in the southwestern United States, but the incidence is not trivial. In Arizona, excluding the greater Phoenix area (Maricopa County), 237 ant stings were reported to poison control centers over a 2-year period (2002-2003), and many more cases probably were not reported. Most of the reported stings were caused by native fire ants and harvester ants.⁶

Although the major cause of adverse reactions to ant stings in the United States is red imported fire ants, attributed with more than 80 deaths since their introduction into the United States,⁷ severe reactions to native fire ant and harvester ant stings in the southwestern United States have been reported.⁶ Two fatalities from native southern fire ant (*Solenopsis xyloni*) (Figure 2) sting reactions have been reported, both infants: (1) one aged 8 months in Keownville, Mississippi,⁸ and (2) another aged 3 months in Phoenix, Arizona, whose death was attributed to an anaphylactic reaction to stings of native fire ants that invaded a day care facility and were found covering the infant in her crib.⁹

Case Report

A 40-year-old male landscaper experienced a severe allergic reaction to multiple stings of *S xyloni* while removing plants from an infested pot at a client's property in Indio, California, on March 11, 2008. The patient immediately drove to an urgent care center, reporting shortness of breath and that his "body felt like it was on fire." Upon presentation, the patient was febrile (temperature, 39.5°C) and markedly cyanotic, and his hand and arm were edematous. He was treated intravenously with diphenhydramine hydrochloride 50 mg, famotidine 20 mg, and methylprednisolone 125 mg; observed; and released. However, the erythema and pruritus persisted for a week. The patient reported experiencing a less severe reaction to fire ant stings 6 years prior that quickly resolved following the administration of diphenhydramine hydrochloride.

Comment

The native southern fire ant (*S xyloni*) is found along the southern United States and northern Mexico. Red imported fire ants (*S invicta*) infest all of the southeastern United States from Florida to

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eastern Texas; northward into southern Oklahoma, Arkansas, Virginia, and Tennessee; and are now established in southern California. The black imported fire ant (*Solenopsis richteri*) was introduced into the United States before *S invicta* but has been largely displaced by that species, except in northeastern Mississippi where populations of *S richteri* and hybrids of *S invicta* and *S richteri* exist.

Two other species of native fire ants also have reportedly caused adverse reactions¹⁰: (1) the desert fire ant (*Solenopsis aurea*), which is found in the Colorado Desert in California and north into southern Nevada along the eastern Mojave Desert, and (2) the tropical fire ant (*Solenopsis geminata*), which has been largely displaced in the southeastern United States by red imported fire ants but has spread to other parts of the world, including many of the Pacific Islands. Two US servicemen stationed in Guam and Okinawa, Japan, experienced near fatal reactions to stings by the tropical fire ant, *S geminata*. Prior to deployment in the Pacific, both men were sensitized to red imported fire ant venom, which is highly cross-reactive with native fire ant venoms.¹⁰ Reportedly, allergic cross-reactivity also exists between venoms of red imported fire ants and common striped scorpions (*Centruroides vittatus*), 2 species that overlap in geographic distribution.¹¹



Figure 1. Red imported fire ant worker (*Solenopsis invicta*).

Native fire ants are less aggressive than red imported fire ants, but their stings can be just as severe. Fire ant venom contains piperidines, alkaloid compounds that are highly neurotoxic, cytotoxic, and hemotoxic, and create an intense burning sensation. The piperidine compounds in fire ant venom vary in structure and each species has its own unique blend, which, in the case of red imported fire ants, causes a pseudopustule to form on the skin (termed *pseudo* because it does not contain pus laden with bacteria but rather sterile serum)(Figure 3). Native fire ant venom typically does not induce pseudopustules, but

Ant Species in the United States Reported to Cause Allergic Reactions³

Scientific Name	Common Name	Geographic Distribution in the United States
<i>Solenopsis invicta</i>	Red imported fire ant	Southeastern United States, New Mexico, California
<i>Solenopsis xyloni</i>	Native southern fire ant	Southern and southwestern United States
<i>Solenopsis richteri</i>	Black imported fire ant	Northeastern Mississippi, Alabama, Georgia
<i>Solenopsis aurea</i>	Desert fire ant	Southwestern United States
<i>Solenopsis geminata</i>	Tropical fire ant	Southeastern United States
<i>Pogonomyrmex rugosus</i>	Rough harvester ant	Western Texas and Oklahoma into southern California
<i>Pogonomyrmex maricopa</i>	Maricopa harvester ant	West Texas into southern California
<i>Pogonomyrmex barbatus</i>	Red harvester ant	Kansas, south to Texas, into Arizona
<i>Pseudomyrmex ejectus</i>	Twig or oak ant	Southern United States
<i>Hypoponera punctatissima</i>	N/A	Florida, Northeast United States, Pacific Northwest United States
<i>Pachycondyla chinensis</i>	Asian needle ant	Georgia to Virginia

Abbreviation: N/A, not available.



Figure 2. Southern fire ant workers (*Solenopsis xyloni*). Photograph courtesy of Sanford Porter, PhD, and David Oi, PhD, United States Department of Agriculture, Agricultural Research Service, Gainesville, Florida.

less severe pseudopustules may form (Figure 4). It is the small protein fraction of the venom (0.1%–1%) that can be allergenic. These trace amounts of protein include hyaluronidase (a spreading factor) and phospholipase (an important factor in allergic reactions).

One fire ant sting is sufficient to precipitate an allergic reaction in sensitized individuals. For most individuals, a sting reaction is limited to urticarial papules, which may be painful for an hour or longer. Anaphylaxis is an immunologic response to venom protein and not a reaction to venom toxicity. Histamine and other chemical mediators released from cells during this immunologic reaction may have profound systemic effects, including hypotension and airway constriction, and some victims describe a feeling of “impending doom.” Anaphylactic reactions vary along a continuum from minor to severe to life threatening. Although urticaria is the most common reaction, patients must be promptly treated because fatal reactions due to cardiopulmonary collapse or a compromised airway usually occur within 30 minutes after an insect sting.

Treatment of Hymenoptera sensitivity should include prevention of stings and immediate treatment of reactions when they occur. Emergency treatment includes administration of H₁ and H₂ antihistamines as well as epinephrine and steroids for more serious reactions, if needed.¹²

Immunotherapy is commercially available for the treatment of anaphylaxis caused by stinging insects. It consists of repeated injections of small amounts of venom from the offending bee or wasp or whole-body extract in the case of red imported fire ants. A mixture of *S richteri* and *S invicta* whole-body extract immunotherapy is recommended for native fire ant stings.⁹



Figure 3. Pseudopustules caused by stings of the red imported fire ant (*Solenopsis invicta*) (A and B). Photographs courtesy of Sanford Porter, PhD, United States Department of Agriculture, Agricultural Research Service, Gainesville, Florida.

Because of the specificity of the allergic reaction to a particular allergen in the venom, identification of the genus and species of the stinging insect by an entomologist is critically important to the allergist or dermatologist. Presently, allergists are able to perform red imported fire ant immunotherapy with commercially available extracts to prevent



Figure 4. Pseudopustules caused by stings of the native southern fire ant (*Solenopsis xyloni*) (A and B).

future life-threatening reactions in select individuals. Some patients with severe reactions to native fire ants also may be eligible for this treatment because of high cross-reactivity between imported and native fire ant venoms. Complete protection remains to be seen, but the standard of care requires the maintenance of adequate records by hospitals, urgent care centers, poison control centers, and all treating physicians involved in present and future care for these patients.

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