

What's Eating You? Fire Ants

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Imported fire ants have become important pests in much of the southern United States, and their territory continues to expand. The ants swarm and sting in large numbers. The intensely painful stings typically develop into intensely pruritic pustules. Life-threatening reactions to fire ant stings occur in sensitized individuals.

Characteristics

The most readily identifiable characteristic of the imported red fire ant, or *Solenopsis invicta*, is its aggressive behavior. When their dome-shaped mound is disturbed, these fire ants “boil” to the surface (Figure 1). Depending on the amount of rainfall, mounds vary in size from almost level with the ground to 6 inches tall. Mounds become taller when there is more rain. Prior to the accidental import of *S invicta* and the less aggressive *Solenopsis richteri* species in the early 1900s, native *Solenopsis geminata* was the most common fire ant in the continental United States. *S geminata* is now relegated primarily to wooded areas of the United States, where *S invicta* is not successful.¹ *S invicta* has eradicated most populations of *S richteri*, though the latter still survives in the cooler northern parts of Alabama and Mississippi. The Table summarizes distinguishing characteristics of the various species of fire ants.²

Fire ant workers vary from 2 to 6 mm in length and have 12-segmented antennae with a club end. Other distinguishing features include a 2-segmented pedicel and an unarmed propodeum.³ When stinging, the fire ant pinches the skin with its mandibles and arches its back to inject venom. Unlike the stinger of a bee, that of a fire ant is not barbed and therefore can be retracted and used again, allowing the fire ant to pivot and make a circle of stings.

Winged ants and winged termites both have 2 pairs of wings; however, the hind wings of fire ants are smaller, and the wings of termites are equal in size.⁴ Another difference is the narrow connection between the abdomen and thorax of fire ants versus the broad waist of winged termites.

Social

After mating in the air, the male fire ants die. Female fire ants can fly from 6 to 24 hours post-insemination, or 1 to 10 miles, before landing to shed their wings. Once on the ground, most of the female ants, or queens, are killed by other ants.⁵ The queens that survive burrow 2 to 5 cm into the soil to lay eggs. These ants rely, in part, on energy absorbed from their wing muscles to survive until worker ants are born and mature to forage for them, which generally occurs within 25 days.

Fire ants sting invertebrates and small vertebrates to devour them for food, but the fire ants mainly consume plants and dead animals. They attract other fire ants to sources of food by leaving species-specific odor trails.⁶ The workers also forage for food for new larvae; in turn, these larvae secrete proteinases such as chymotrypsin that digest foods for the rest of the colony.⁷ The proteinases must be regurgitated to workers and to queens, who do not possess these necessary enzymes. The enzymes also may stimulate further egg production. A well-nourished queen can then produce up to 800 or more workers a day.

The worker caste also constructs the mound, which increases the warmth of the ants, as well as elevates the young larvae above the water table.

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Figure 1. Fire ant mound.

Distinguishing Features of Fire Ants Found in the United States²

Species (Alias)	Color	Characteristic Locations	Pustules	Mounds
<i>Solenopsis invicta</i> (imported fire ant)	Red-brown	Southeastern United States, Brazil, Argentina	Pustules	Dome mounds (Figure 1)
<i>Solenopsis richteri</i> (imported fire ant)	Black	Northern Alabama and Mississippi, Uruguay, Argentina	Pustules	Dome mounds
<i>Solenopsis geminata</i> (tropical fire ant)	Yellow-brown	Florida, Caribbean, Pacific, Mexico, Central America, Asia	± Pustules	Very low mound
<i>Solenopsis aurea</i> (desert fire ant)	Bright gold	Southwestern United States	No pustules	No mound
<i>Solenopsis xyloni</i> (southern fire ant)	Red heads with brown abdomens	Southern United States	No pustules	No mound

Data are from Hoffman.

Other warm, moist environments, such as rotten wood and electrical boxes, enable fire ants to survive without the benefit of a mound. In the southern United States, fire ant colonies are a common cause of short-circuit damage to electrical boxes and air conditioner units. When a mound is present, its size is in direct proportion to the size of the colony.

Clinical Manifestations

The term *fire ant* stems from the burning sensation that results from its sting. Unintentionally disturbing a mound may result in many stings because the ants swarm insidiously, and the victim is not aware of the swarm until all at once the ants begin stinging. The acute burning lasts several minutes and may be



Figure 2. Early wheal-and-erythema reaction to fire ant sting.



Figure 3. Stings occur in a circular fashion as the fire ant bites and pivots.



Figure 4. Rosette pattern of stings.

accompanied by a wheal-and-erythema reaction (Figure 2). As the fire ant grasps the skin and delivers a series of stings in a circular fashion (Figure 3), the pustules are often noted in a pattern of rosettes (Figure 4). Disseminated solitary pustules also are common (Figures 5–7). The presence of pruritus and absence of tenderness helps differentiate sterile pustular reactions from secondary infection. Vesiculopustular reactions are common and can coalesce to form bullae. Widespread lesions often are associated with edema of the surrounding skin.

Whole venom from fire ants initially increases plasma membrane permeability. This is followed by the release of histamine from mast cells, though this may not occur at temperatures below freezing, thereby thwarting the ability of fire ants to defend themselves in cold climates.⁸ Similarly, stings in winter may go unnoticed until a local reaction occurs, as venom may be 100 times less concentrated in winter months. During other times of the year, after the burning subsides, itching often develops within 20 minutes. The sterile pustules generally develop within 10 hours and last for days to weeks. The pustule is a result of venom-activated aggregation of platelets and activation of neutrophils and is unique to the sting of the fire ant.⁹

Fire ants are an important cause of anaphylaxis in areas where they are endemic; also, death may occur in individuals who are allergic to fire ant stings. Most anaphylactic reactions occur in those individuals with previous exposure; however, others may presumably be presensitized by yellow jacket venom, which may cross react with that of the fire ant.¹⁰

There are several reports of fire ant attacks on residents in

healthcare facilities. Such individuals usually have neurologic impairment.¹¹ Some have been stung up to 10,000 times. An indoor occurrence signals the presence of colonies in the vicinity. These must be identified and eradicated. Children playing outdoors are at increased risk for fire ant stings. Mounds are common near playgrounds and at the base of sliding boards. Nephrotic syndrome associated with fire ant stings has been reported after multiple stings, and both adults and children should be monitored for adverse reactions.¹²

Currently, fire ants are endemic in southern states. They do not tend to flourish in dry or cold climates ($<10^{\circ}\text{F}$), but a hybrid of these 2 imported fire ants is already beginning to move to more northern US states such as Virginia.¹³ Imported fire ants now inhabit more than 300 million acres of the United States, with new colonies also spreading west to Arizona, California, and New Mexico. Spread of this organism is believed to occur through infested plants, long mating flights, and flood waters. Fire ant stings are becoming more prevalent as the number of colonies increases. Evidence suggests that fire ants sting as many as 50% of the people living in endemic areas.¹³

Diagnosis

Diagnosis is generally made by the presence of the characteristic pruritic pustule and description of a fire ant mound in the vicinity of the sting. Laboratory tests are of limited value in patients without significant hypersensitivity. In one study, venom-specific immunoglobulin E was only able to confirm 16% of fire ant stings.¹⁴ Death caused by fire ant stings is generally confirmed by blood sample results positive for venom-specific immunoglobulin E antibodies and tryptase.¹⁴



Figure 5. Solitary sting.



Figure 6. Sterile pustules resulting from fire ant stings.



Figure 7. Multiple fire ant stings.

Treatment

Individuals with severe fire ant hypersensitivity should be evaluated by an allergist for desensitization. Rush immunotherapy with imported fire ant whole body extract has been demonstrated to be effective.¹⁵ These individuals also should be provided with a source of injectable epinephrine. Some data suggest that intramuscular injections provide more reliable absorption than subcutaneous injection.

The cost of fire ant-related medical care in 1998 in South Carolina alone was estimated at \$2.4 million.¹⁶ Ants can be effectively removed by rubbing or washing with soap. Treatment for local reactions may consist of iced compresses and elevation of affected extremities. Potent fluorinated topical steroids can relieve itching. Secondary infection is rare, and prophylactic use of antibiotics is not routinely recommended.

There are a variety of pesticides in use to eradicate fire ants. For example, bait insecticides containing hydramethylnon and sulfuramid are spread in breadcrumb-size granules. In the authors' experience, Amdro[®] fire ant bait is extremely effective. Other treatments include avermectins, spinosyns, pyrethrin derivatives, insect growth regulators, and a variety of botanicals. Biologic treatments include parasitic microsporidia (*Thelohania solenopsae*) and a parasitic ant (*Solenopsis dagerrei*). Decapitator flies may be imported from South America to help control fire ants. This fly injects its eggs into as many as 200 fire ants. The resultant larvae travel to the brain and release enzymes, which decapitate the ant.¹⁷

Conclusion

Fire ant infestation is a major problem in the southeastern United States, and the range of the imported fire ant continues to increase. The ants swarm and sting in great numbers. Pain subsides within minutes after the sting, but itching can last for weeks. Itching responds to potent topical corticosteroids. Patients with severe reactions should be provided with epinephrine and promptly referred to an allergist.

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