

Red imported fire ants in Hong Kong

The recent discovery of *Solenopsis invicta* Buren, also known as the red imported fire ant (RIFA), in the Guangdong Province of China and subsequently in Hong Kong has sparked interest in this unusual aspect of medical entomology among the general population. As *S invicta* is an imported and invasive species, local medical practitioners, government officials, and the public at large are generally unfamiliar with the clinical and public health significance of this insect. Consequently, a number of uncertainties and misconceptions arose during the early stages of this incident.

Medically important arthropods (Phylum Arthropoda) most commonly belong to the classes Insecta (insects) and Arachnida (ticks, mites, spiders, scorpions), although members of other classes such as Copepoda (copepods), Diplopoda (millipedes), and Chilopoda (centipedes) are also important either as intermediate vectors of infectious agents or as the direct cause of injuries to humans. Arthropods are best known for their ability to serve as biological vectors of infectious agents, such as malaria, arboviruses, and rickettsiae, or as mechanical carriers in the transmission of pathogens (eg flies and cockroaches). Other arthropods feed on human and animal blood or body fluids, acting as transient or permanent ectoparasites (eg ticks, mites, lice, fleas, and the scabies mite, *Sarcoptes scabiei*). A third group of arthropods can cause substantial tissue injury, especially in their larval stages. These are best exemplified by the myiasis flies, especially obligatory myiasis species, such as *Chrysomya bezziana* in the Old World and Hong Kong. Envenomation is a fourth important mechanism of arthropod-inflicted injuries. Venoms from some spiders and scorpions can cause substantial soft tissue necrosis (eg the recluse spiders, *Loxosceles* spp), neurotoxicity (eg the black widow spider, *Lactrodectus mactans*), and even death, although such species are rare in this part of the world. Bee or wasp stings occasionally occur in Hong Kong; however, mortality is rare with the exception of occasional victims who suffer an anaphylactic reaction to the venom.

The imported fire ants are indigenous to South America. The black fire ant *Solenopsis richteri* Forel first found its way into the United States around 1918 through Alabama. In the 1930s, the red fire ant, *S invicta*, also invaded the southern United States and has since become the more successful species, with an endemic area covering over 1.2 million km² and 13

states.¹ Very high densities of RIFAs are found in some areas, in which over half of the human populations are stung by *S invicta* every year. The stings cause a fiery sensation and can be dangerous when large numbers of ants attack a single victim. Red imported fire ants also pose a threat to infrastructure when their mounds are located around man-made facilities or damage crops in agricultural communities. Ecologically, fire ants may reduce biodiversity, impacting other ant species, invertebrates, reptiles, and even birds and mammals.

The clinical spectrum of human injuries from RIFA stings have been well described.² Stings are often multiple, due in part to the ability of each fire ant to sting repeatedly, and in part to the swarming of tens or hundreds of ants onto a single victim when disturbed. Fire ant venom is composed predominantly of alkaloids, with only 1% being proteins. This is in contrast to most other arthropod venoms in which proteins are the major component. The alkaloids demonstrate a number of biological effects, including cytotoxicity, which account for the characteristic skin lesions, but it is the proteins that are responsible for the allergic responses. The skin lesions follow a characteristic course of progression. A wheal-and-flare reaction appears a few minutes after the sting, which usually resolves in 30 minutes. Within the following 24 hours, a sterile pustule, which is almost pathognomonic of fire ant stings, appears and persists for several days. The healing process may last for several weeks and is sometimes associated with scarring. When the skin overlying the pustule breaks down, secondary bacterial skin infections or even sepsis can complicate the condition; these are particularly important in diabetic patients.

Between 17% and 56% of victims develop venom-specific immunoglobulin E. These patients may develop the so-called large local reactions at the site of subsequent stings: indurated lesions that are erythematous, oedematous, very pruritic, and characterised by neutrophilic and eosinophilic infiltrates in the soft tissues. The oedema may sometimes be severe enough to apply pressure to underlying nerves and vessels. In less than 1% of patients, anaphylaxis may occur with subsequent stings.

Fire ants attaching to the skin can be removed with a brushing motion; shaking or dipping the limb in

water does not remove the ants as they attach to the skin by their strong mandibles. The management of uncomplicated skin lesions is symptomatic relief of pruritus and pain, typically with topical corticosteroids (eg 1% hydrocortisone, 0.1% triamcinolone) and oral antihistamines. The formation and progression of the sterile pustule, however, is not affected by any drugs. Prophylactic antibiotics are not indicated; antibiotics are used only in the presence of secondary bacterial infection. Systemic corticosteroids may be used for patients with systemic hypersensitivity reactions to RIFA venom. Anaphylactic reactions should be managed with adrenaline, systemic corticosteroids, and antihistamines.

Although *S invicta* is primarily an outdoor species, injuries sustained indoors are definitely possible. At times of environmental stress, such as extremes of temperature and humidity or diminished food supply, RIFA mounds may be located near human dwellings, and worker ants may forage indoors for food and moisture. Under certain circumstances, mounds may also be found indoors. The urban environment provides numerous suitable habitats for *S invicta*, and mounds may be formed in lawns, ornamental turfs, parks, along pavements, and so on.

What is more worrying is that the ability of RIFAs to attack residents in health care facilities. As of 2004, there had been at least 12 reported cases of indoor RIFA attacks on humans, with six of them occurring in health care facilities.^{3,4} These six cases were reported from endemic areas in the United States (Florida, Texas, and Mississippi) among residents of nursing homes. The victims ranged in age from 60 to 90 years, and all were immobile requiring chronic care for hemiplegia, quadriplegia, Alzheimer's disease, or dementia. Four out of the six victims died within 1 week of attack. The epidemiology of RIFA attacks on residents of nursing homes is reminiscent of the growing problem of myiasis due to *C bezziana* in Hong Kong: patients are often immobile and unable to defend themselves against these insects.

While the number of cases of nursing home residents being attacked by RIFAs is relatively small even in endemic areas, health care workers and the

Hong Kong Government must be aware of such threats. The exact distribution of *S invicta* in Hong Kong, as well as the magnitude of the problem, has not been delineated precisely. The possibility of indoor invasion of health care facilities should not be dismissed at this early stage, and means to prevent such injuries from occurring should be considered.⁵

Although no RIFA sting injuries have been reported in Hong Kong, this is probably due to the unawareness of the local presence of this species. Since the discovery of RIFA in Hong Kong, there have been occasional retrospective reports in the media of skin conditions almost pathognomonic of RIFA stings. These are hardly surprising since RIFAs have probably been established in Hong Kong for some time given the large number of mounds found in almost every district of the territory within the first 2 weeks of the initial discovery. As it would be extremely difficult, if not impossible, to eradicate the RIFA once it has gained a foothold, it would not be surprising if local medical practitioners start to see cases of RIFA-inflicted injuries in the future.

SSY Wong, MRCPATH, DTM&H
KY Yuen, FRCPATH, MD
(e-mail: hkumicro@hkucc.hku.hk)
Department of Microbiology
The University of Hong Kong
Queen Mary Hospital
Pokfulam Road
Hong Kong

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