

Arthropod Envenomation in North America



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KEYWORDS

- Arthropods • Spiders • Scorpions • Hymenoptera • Bees • Ants • Ticks
- Centipedes

KEY POINTS

- Black widow spider bites cause painful muscle spasms, secondary to neurotoxicity, and are responsive to antivenom therapy.
- Brown recluse spider bites result in hematotoxicity and most commonly manifest locally as skin necrosis.
- Scorpion stings in North America produce severe localized pain with occasional neurotoxic systemic effects.
- Hymenoptera stings from bees and wasps can result in local skin reaction to severe anaphylactic reactions and are responsible for more fatalities than any other venomous arthropod.
- Fire ant stings can cause multiple painful localized skin reaction and pustules.

SPIDERS

There are nearly 40,000 species of spiders worldwide (class Arachnida). Most species cannot inflict serious bites to humans because they do not have fangs long enough to penetrate the human skin.^{1,2,3} As a result, most exposures are often unnoticed and do not need treatment. In North America, approximately 50 species of arachnids potentially cause human morbidity. Spiders use their venom to paralyze and liquefy their prey. There are only a few medically relevant spiders that produce toxic venoms that can lead to local reactions, systemic illnesses, hematotoxicity, and neurotoxicity.

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Black Widow Spiders

Introduction

The *Latrodectus* genus of spiders includes 5 primary species found in North America: *Latrodectus mactans*, *Latrodectus bishop*, *Latrodectus geometricus*, *Latrodectus hesperus*, and *Latrodectus variolus*.³ They live in dimly lit, secluded areas such as wood-piles, stonewalls, cabins, barns, stables, and outhouses. They are present in southern Canada and every US state except Alaska.⁴ Black widows are jet black with an iconic red hourglass marking on the ventral aspect of the abdomen (Fig. 1). The red hourglass is specific to *L. mactans*; other species have distinctive ventral markings, such as triangles and spots. There is a seasonal variation in the number of black widow bites, starting to increase in spring, peaking in September, and reaching a nadir in January to February.⁴

Black widows are docile and nocturnal and bite when their web is disturbed. The female black widow is generally considered poisonous to humans and is more aggressive if guarding her egg sac. The male black widow spider has smaller jaws with minimal venom production and is not significantly poisonous to humans. These spiders use striated muscles to control the amount of venom they inject, and about 15% of bites do not deliver venom.⁵ The venom's toxicity is due to the presence of α -latrotoxin. This toxin facilitates exocytosis of synaptic vesicles and the release of the neurotransmitters norepinephrine, γ -aminobutyric acid, and acetylcholine.⁶ The toxin also causes degeneration of motor end plates, resulting in denervation. The venom destabilizes nerve cell membranes by opening ion channels, causing a large influx of calcium into the cell and depletion of acetylcholine from presynaptic nerve terminals.

Patient evaluation overview

Latrodectism is the clinical syndrome that follows a black widow bite. The bite produces a pinprick sensation that often goes unnoticed. With careful examination, 2 small fang marks may be noticed. Within the first few hours, local irritation develops, including erythema, urticaria, or a characteristic halo-shaped target lesion. These local symptoms may be followed by generalized symptoms of pain and muscle spasms in the chest, abdomen, and lower back. Typically, the pain is concentrated to the chest with upper extremity bites and abdomen with lower extremity envenomation. Abdominal rigidity can be severe and may be mistaken as an acute abdomen.^{7,8} Signs and symptoms in small children are wound erythema, irritability, constant crying, sialorrhea, agitation, and seizures. Victims experience pain on the wound site, muscle



Fig. 1. Black widow spider, *Latrodectus mactans*. (Courtesy of CDC/Paula Smith; and James Gathany.)

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