

# Tropical dermatology: Venomous arthropods and human skin

## Part II. Diplopoda, Chilopoda, and Arachnida

Vidal Haddad, Jr, MD, PhD,<sup>a</sup> João Luiz Costa Cardoso, MD,<sup>b</sup> Omar Lupi, MD, PhD,<sup>c</sup>  
and Stephen K. Tyring, MD, PhD<sup>d</sup>

*Botucatu, Manaus, and Rio de Janeiro, Brazil; and Houston, Texas*

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Members of arthropod classes Chilopoda (centipedes), Diplopoda (millipedes), and Arachnida (spiders and scorpions) cause tissue injury via bites, stings, and/or a release of toxins. A few members of the Acari subclass of Arachnida (mites and ticks) can transmit a variety of infectious diseases, but this review will cover the noninfectious manifestations of these vectors. Dermatologists should be familiar with the injuries caused by these arthropods in order to initiate proper treatment and recommend effective preventative measures. (J Am Acad Dermatol 2012;67:347.e1-9.)

**Key words:** bite; centipede; envenomation; millipede; mite; scorpion; spider; sting; tick; tropical dermatology.

## DIPLOPODA AND CHILOPODA

### Key points

- Centipedes have fangs that feature poison glands containing metalloproteases; the main symptom of injury is pain
- Millipedes have lateral glands, instead of fangs, which contain cyanide and quinones; the main sign of injury is hyperpigmentation

Centipedes and millipedes belong to the classes Chilopoda and Diplopoda, respectively. Most species of the first class are carnivorous and have a body made of flattened segments covered with chitin with a pair of legs on each segment. The first segment has 2 large tusks originating from the pair of legs, which act as organs of defense and also as a method to capture prey—these animals are able to inject poison from glands contained in the trunk. The venom contains several different enzymes, especially metalloproteases, that have myotoxic, cardiotoxic, and neurotoxic activities. The *Scolopendra* genus

### CAPSULE SUMMARY

- Centipede bites cause pain and erythema via metalloproteases, which can be treated with cold compresses and analgesics.
- Millipede contact can result in erythema and hyperpigmentation via cyanide and quinones, which can be treated with topical alcohol.
- The brown recluse spider bite can produce extensive skin necrosis (ie, loxoscelism via sphingomyelinase D), which can be treated with antivenom and/or sulfones.
- Tarantula bites can cause pain via activation of capsaicin receptor, which can be treated with analgesics.
- Tarantula contact with body bristles can result in dermatitis and conjunctivitis via allergic reactions, which can be treated with topical corticosteroids and oral antihistamines.
- Scorpions stings can produce cutaneous necrosis, bullae, and multisystem failure, including death via tityustoxin, hemicalcin, and a complex mixture of basic proteins, which can be treated with local anesthetics, antiserum, and cardiopulmonary life support.
- Tick bites or burrowing mites can activate an immunoglobulin E–driven  $T_H2$  response with erythema, edema, papules, and pruritus, which can be treated with topical corticosteroids and oral antihistamines.

reaches up to 25 inches long and causes the most serious injuries (Fig 1).<sup>1-3</sup>

Millipedes are structurally similar to the Chilopoda but they do not have cephalic fangs and have 2 pairs of legs on each body segment (Fig 2). They have lateral glands in each segment that produce cyanide and quinones to repel predators. Occasionally, skin and mucous membrane lesions can be observed in humans.<sup>4</sup>

Injuries in humans caused by Chilopoda (centipedes) are observed sporadically, and pain is the main symptom, with mild erythema and edema at the site of injury (Fig 3). A few case reports have noted the onset of headache, malaise, anxiety, and dizziness. The injury is characterized by 2 points where there is penetration of the fangs. There are rare reports of human deaths caused by the bites of centipedes.<sup>1,5,6</sup> Secondary infection is a major complicating factor in the envenomation.

Millipedes do not have fangs, but their toxic fluids may be ejected and cause erythema and brown or

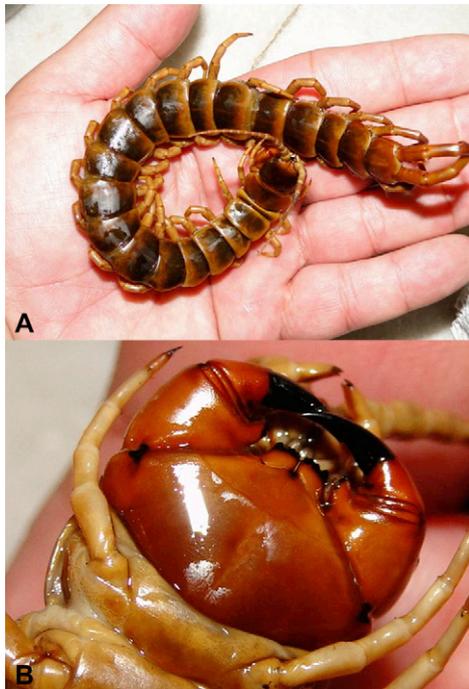
From the Department of Dermatology of the Faculdade de Medicina de Botucatu at Univ Estadual Paulista,<sup>a</sup> Vital Brazil Hospital, Instituto Butantan and Fundacao de Medicina Tropical do Amazonas,<sup>b</sup> Manaus; Universidade Federal do Estado do Rio de Janeiro and Policlínica Geral do Rio de Janeiro,<sup>c</sup> Immunology Section, Faculdade de Medicina, Universidade Federal do Rio

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Reprint requests: Stephen K. Tyring, MD, PhD, Center for Clinical Studies, University of Texas Health Science Center, 451 N Texas Ave, Houston, TX 77598. E-mail: [styrying@ccstexas.com](mailto:styrying@ccstexas.com).

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**Fig 1.** Centipede. **A**, The *Scolopendra* genus (Chilopoda) reaches up to 25 inches long and can cause marked envenomation with severe pain. **B**, The fangs of the arthropod. Photograph courtesy of Vidal Haddad, Jr, MD.

black pigmentation in the affected skin (Fig 4).<sup>7</sup> Injuries most often occur when victims put on their shoes, because millipedes often enter homes seeking dark places to take refuge. The pigmented lesions may persist for months.<sup>8</sup>

When the injury is caused by a centipede, there is spontaneous resolution without complications. The site should be washed with soap and water; cold compresses should be tried. Analgesics are essential for pain control (Table I).<sup>9</sup>

Millipedes cause acute inflammatory lesions without major repercussions. The immediate use of alcohol or ether on the site is encouraged, because it could dissolve toxins.<sup>4</sup> Eye injuries should be washed, and the patient should be referred to an ophthalmologist, because severe envenomation can result in blindness.<sup>10</sup>

## ARACHNIDA

### Spiders

#### Key points

- **Brown recluse spiders can cause extensive skin necrosis and acute renal failure via sphingomyelinase D; therapy is with antivenom (antivenin) and/or sulfones**
- **Tarantulas can release bristles resulting in dermatitis and conjunctivitis or can bite causing pain via activation of the capsaicin**



**Fig 2.** Millipede. Diplopoda can cause lesions in humans with initial inflammation and marked pigmentation. Photograph courtesy of Vidal Haddad, Jr, MD.



**Fig 3.** Centipede. Envenomation by Chilopoda. Note the erythema and the small perforation. Photograph courtesy of Vidal Haddad, Jr, MD.

#### **receptor; treatment includes the use of oral antihistamines and topical steroids**

Spiders that cause major injuries in humans belong to the genus *Atrax* (the funnel web spider of Australia, of the Orthognata infraorder), genus *Phoneutria* (armadeira spider), genus *Latrodectus* (the black widow spider), and the genus *Loxosceles* (the brown recluse spider; Fig 5). The first 3 spiders cause serious injuries with a risk of death, but the toxins are primarily neurotoxic, and little or no change is noted in the skin of a local sting.<sup>1-3</sup>

Brown recluse spiders, however, cause exuberant skin manifestations. These spiders live in dark and dusty places, such as garages and warehouses, being cosmopolitan (with the exception of cold places).<sup>1-3</sup> The venom is capable of causing extensive skin necrosis, and in about 5% of cases hemolysis can cause acute renal failure, especially by the action of sphingomyelinase D, an enzyme that destabilizes the vessel walls and membranes of red blood cells.<sup>11,12</sup>

*Loxosceles* spiders are timid animals and run away when in danger, only biting when pressed against the victim's body or handled without care. The



**Fig 4.** Millipede. **A** and **B**, Classic late hyperpigmentation after the crushing of a millipede in a shoe. Photograph courtesy of Vidal Haddad, Jr, MD.

manifestations begin with a burning sensation or can even be painless. About 6 hours later, an ischemic area is clearly delineated with cyanotic, pale, and erythematous variations of color in the affected area—a characteristic sign known as a marble plaque (Fig 6). During this period, it is possible to observe blisters with a hemorrhagic content, and the injury is very painful because of local ischemia. The plaque evolves to frank necrosis in about 1 week, and an eschar remains firmly attached for up to 3 weeks (Fig 7). At this stage, there is no more pain. When the eschar finally falls off, a large and deep ulcer can be seen, typically with a granular base and elevated edges. In this phase, confusion with other ulcers is common, especially with cutaneous leishmaniasis (Fig 8). The ulcer healing is slow and resolves after months.<sup>13,14</sup>

The differential diagnosis of necrotic araneism depends on the phase of the injury: in the initial envenomation, the differential diagnosis includes cellulitis, erysipelas, and necrotizing fasciitis. In the necrotic phase, there may be confusion with skin necrosis caused by other animals (eg, snakes), drugs, and bacteria. At the ulcer stage, it is necessary to differentiate from other chronic ulcers, such as mucocutaneous leishmaniasis, paracoccidioidomycosis, sporotrichosis, cutaneous tuberculosis, and cutaneous squamous cell carcinoma. Histopathology allows for the correct diagnosis, because in cutaneous loxoscelism there is fibrosis and neovascularization;

these alterations are not found in granulomatous processes.<sup>15</sup>

Treatment of cutaneous loxoscelism also depends on the phase of the injury: early diagnosis allows for the reduction of the clinical manifestations by use of antivenom against the toxins of the spider, but it is not used in all countries. An alternative is to use sulfone (100-300 mg daily) to prevent the diapedesis of neutrophils to the point of ischemia and reduce necrosis. Corticosteroid use is controversial. In later stages with large ulcers, it is possible to use skin grafts for repair.<sup>16-19</sup>

Some Theraphosidae spiders (tarantulas) can liberate body bristles (especially of the abdomen) and cause an irritant dermatitis and conjunctivitis in humans.<sup>20,21</sup> Tarantula bites can cause pain via activation of the capsaicin receptor.<sup>22</sup> These injuries are common in persons that have contact with the spiders (eg, biologists). The lesions are highly pruriginous, but can be treated with topical corticosteroids and oral antihistamines (Figs 9 and 10).<sup>23</sup>

## Scorpions

### Key points

- **Most scorpion stings cause cardiac arrhythmias and acute pulmonary edema without significant skin changes; the venom of *Tityus serrulatus*, containing tityustoxin, is the most potent**
- **The sting of *Hemiscorpius lepturus*, found in Iraq and Afghanistan, can result in extensive skin necrosis and neurotoxic symptoms caused by hemicalcin**
- **All severe stings should be treated with anti-scorpion serum; anesthetics without vasoconstrictors can be used for local pain**

Scorpions are dangerous animals that are present in all tropical and temperate regions and can cause death in children and debilitated individuals<sup>4</sup> (Fig 11). Their venom causes intense stimulation of the autonomic nervous system, resulting in cardiac arrhythmias and acute pulmonary edema. In the majority of the scorpions' stings, there are no significant skin manifestations<sup>4</sup> (Fig 12). Some species, however, can cause necrotic and purpuric plaques that can ulcerate or form bullae (Fig 13).

There are 6 families of scorpions, but almost all scorpions dangerous to humans are in the Buthidae family.<sup>24</sup> The most common genus in this family in the United States is *Centruroides* spp.<sup>25</sup> The most scorpion stings reported in humans are from the Tityinae subfamily of Buthidae, which is found in Brazil and Venezuela. The venom of *Tityus serrulatus* is the most potent and results from

**Table I.** Management of injuries from Diplopoda, Chilopoda, and Arachnida

Arthropod class	Injurious components in venom/ mechanism of injury	Signs and symptoms	Management
Chilopoda (centipedes)	Metalloproteases (bite)	Erythema, edema, and pain	Wash site, cold compresses, and analgesics
Diplopoda (millipedes)	Cyanide and quinones (contact)	Erythema, pigmentation, and blindness	Wash site and topical alcohol
Arachnida (spiders)	Brown recluse— sphingomyelinase D (bite); tarantula—activation of capsaicin receptor (bite), allergic response (contact)	Brown recluse—ischemia, marble plaque, bullae, necrosis, eschar, and ulcer; tarantula—dermatitis, conjunctivitis, pain, and pruritus	Brown recluse—antivenom and sulfone; tarantula—topical corticosteroids and oral antihistamines
Arachnida (scorpions)	Tityustoxin, hemicalcin, and a complex mixture of basic proteins (sting)	Erythema, purpura, bullae, necrosis, ulcers, pain, nausea, vomiting, coughing, wheezing, heart failure, pulmonary edema, tremors, shock, and death	Local anesthetics, antiserum, and cardiopulmonary life support
Arachnida (mites and ticks)	Antigen activation of immunoglobulin E—driven T <sub>H</sub> 2 response (contact)	Erythema, edema, papules, pruritus, and secondary bacterial infection	Topical corticosteroids, oral antihistamines, and antibiotics for infections



**Fig 5.** Brown recluse spider. *Loxosceles reclusa*, one of the species of brown recluse spider. Photographs courtesy of Vidal Haddad, Jr, MD.

tityustoxin. This toxin binds to voltage-dependent sodium and potassium ion channels, causing sialorrhea, lacrimation, and rhinorrhea.<sup>26</sup>

There are many reports of scorpion stings in American troops stationed in Iraq and Afghanistan.<sup>27</sup> The scorpion reported to produce the most cutaneous injury in this region is *Hemiscorpius lepturus*. The sting of this scorpion can produce erythema, purpura, bullae, necrosis, and ulcers (Fig 13).<sup>28</sup> A novel toxin from *H lepturus* is hemicalcin, which is active on ryanodine-sensitive calcium channels and produces neurotoxic symptoms.<sup>29</sup>

Scorpion venom is a complex mixture of basic proteins of low molecular weight with small amounts of amino acids and salts, without hemolytic, protease, cholinesterase, or phospholipase activities or the consumption of fibrinogen. The site of the sting is sometimes detected with difficulty, and only mild edema and erythema can be observed with or



**Fig 6.** **A** and **B**, The marble plaque: a characteristic sign of the ischemia and necrosis caused by the envenomation by *Loxosceles* spiders. Photograph courtesy of Vidal Haddad, Jr, MD.

without sweating and horripilation. In addition, there may be nausea, vomiting, and colic type abdominal pain along with rhinorrhea, coughing, sneezing, and wheezing. Additional changes can occur, such as tachycardia or bradycardia (alternate or not), hypo- or hypertension, arrhythmias, chest tightness, heart failure, acute pulmonary edema, and



**Fig 7.** Brown recluse spider. An eschar is the second step in the development of the typical envenomation by *Loxosceles*. Photograph courtesy of Vidal Haddad, Jr, MD.



**Fig 8.** Brown recluse spider. A deep ulcer with infiltrated edges is the final evolution of the brown spider envenomation. This ulcer can be confused with granulomatous and neoplastic diseases. Photograph courtesy of Vidal Haddad, Jr, MD.



**Fig 9.** Tarantulas (Theraphosidae) are large spiders that can be dangerous, but the majority of the species do not cause envenomation. They can liberate bristles of the abdomen, which cause dermatitis in humans. Photograph courtesy of Vidal Haddad, Jr, MD.

shock, the latter being the most severe manifestations of scorpion sting.<sup>30</sup> Envenomation can cause tremors, psychomotor agitation, and myoclonus.



**Fig 10.** Tarantula dermatitis. These are the hands of a biologist who works in research on Theraphosidae spiders and who presented with erythematous and pruritic papules caused bristles on the skin. Photograph courtesy of Vidal Haddad, Jr, MD.



**Fig 11.** Scorpions are dangerous animals that cause severe envenomation in humans (especially in children). This specimen is a *Tityius serrulatus*, a Brazilian (devil) yellow scorpion. Photograph courtesy of Vidal Haddad, Jr, MD.

Severe injuries present with systemic manifestations that are quite obvious and intense. Profuse and frequent vomiting is one symptom, and the intensity and frequency of vomiting is a sensitive premonitory sign of the severity of poisoning. Other symptoms include widespread and abundant sweating. Patients typically complain of cold, goose flesh, pallor, severe agitation alternating with drowsiness, hypothermia, tachycardia or bradycardia, extrasystole, hypertension, hyperpnea, tremors, and muscle spasms. There may be progression to cardiocirculatory and pulmonary edema, which are frequent causes of death. Treatment includes neutralizing the circulating toxin as quickly as possible, combating the symptoms of envenomation, and supporting the vital conditions of the patient.<sup>31</sup> Local pain can be combated with anesthetics without vasoconstrictors, lidocaine 2% or bupivacaine 0.5% injected into the sting site, or in the form of regional blocking. The recommended dose is 3 to 4 mL for adults and 1 to 2 mL in children and



**Fig 12.** Scorpion sting. The site of a scorpion sting usually shows no important skin alterations. There is only a mild local inflammation. Photograph courtesy of João Luiz Costa Cardoso, MD.



**Fig 14.** A tick on human skin looking for a place to start its blood meal. Photograph courtesy of Vidal Haddad, Jr, MD.



**Fig 13.** Bullae from the sting of a scorpion (*Hemiscorpius lepturus*) in an American soldier in Iraq. Photograph courtesy of John Paul Trafeli, MD, and James W. Steger, MD, Department of Dermatology, Naval Medical Center, San Diego, CA.



**Fig 15.** The “comet” sign. Ticks spread themselves after they obtain victims by hiding in low shrubs. Photograph courtesy of João Luiz Costa Cardoso, MD.

may be repeated up to 3 times at intervals of 30 to 60 minutes.

Antiscorpion serum is indicated in all severe cases.<sup>31-33</sup> In 2011, the FDA approved the first treatment specifically for scorpion stings, ie, *Centruroides* (Scorpion) Immune F(ab')<sub>2</sub> Injection (trade name, Anascorp, Rare Disease Therapeutics, Inc, Franklin, TN). The most feared complications of scorpion injuries are cardiac arrhythmias, shock, and pulmonary edema that can sometimes lead to death, even with proper medication and acute care—especially in children.

## Ticks and mites

### Key points

- The “comet” sign is classic for tick or mite bites; pruritus may result from hypersensitivity or foreign body reactions
- An immunoglobulin E–driven T<sub>H</sub>2 response to mites can manifest as pruritic papules;

### mite infestations can be treated with topical permethrin and/or oral ivermectin

Some arthropods that cause skin lesions are commonly mistaken for venomous animals. Ticks (Arachnida class, Acari subclass, and Ixodida order) can be a vector for agents of a variety of diseases, including Rocky Mountain spotted fever, Colorado tick fever, tick paralysis, tularemia, tick-borne relapsing fever, babesiosis, ehrlichiosis, and Lyme disease<sup>1-3</sup> (Fig 14). They also can provoke severe local reactions through hypersensitivity and by foreign body reactions precipitated by the persistence of fragments of mouthparts at the bite. These reactions are extremely pruritic and become infected easily in predisposed individuals because of intense erythema and edema. There is a classic sign of tick's (or mite's) or their nymph's bites (ie, the “comet” sign, where many bites spread from initial points in

the distal areas of the ankles and legs, with a cone distribution (Fig 15).<sup>34</sup> This occurs by the ascending movement of 1 or more ticks.

Mites are also members of the Acari subclass and include vectors of various infectious diseases, such as scrub typhus and rickettsialpox. The most common cutaneous manifestations of mites, such as chiggers, scabies, and demodex, are pruritic papules caused by an immunoglobulin E-driven T<sub>H</sub>2 response and which are seen worldwide.<sup>35</sup> Mite infestations may be treated with topical agents, mainly 5% permethrin or oral ivermectin.<sup>36</sup> Although scabies is more prevalent, more frequently associated with secondary staphylococcal and streptococcal infections,<sup>37</sup> and often more severe in tropical parts of the world, the cutaneous manifestations are very similar to those seen in temperate countries and therefore will not be discussed in this review.

Although a few members of the Acari subclass of arthropods transmit infectious diseases, the majority of Diplopoda, Chilopoda, and Arachnida cause tissue injury via release of toxins or by burrowing into the skin. It is important for dermatologists to be familiar with these arthropods and the injuries they cause in order to initiate proper therapy and to advise the patient on effective prevention.

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