## Summary


- *Latrodectus* (black widows): neurotoxic. Acute abdominal pain. Limited local signs
- *Loxosceles* (violin spiders): cytotoxic. Local pain, skin necrosis, rarely systemic symptoms
- Mygalomorph spiders: fine urticarial hairs. Itching and eye damage. Respiratory problems
- Funnel-web spiders: Neurotoxic and local pain
- *Phoneutria* (banana spiders): local pain and systemic reactions


## General

The subphylum of the Chelicerata includes 4 classes: Euryptera (extinct), Pycnogonida (sea spiders), Merostomata (horseshoe crabs) and Arachnida. The latter includes animals such as spiders, scorpions, mites and ticks. The name “Chelicerata” refers to the modified mouth parts (chelicerae). Spiders form the order of the Araneida (id. Araneae) within the Arachnida. The number of spider species is estimated to be 30,000 to 34,000. There are only a small number of spiders which are potentially harmful for human beings. The reason for this is that most species simply have too little venom or their fangs are too short to penetrate human skin. The venom of some spiders is only active against their natural prey and has no effect on human beings. Finally for some species the probability of spider-human contact is very low. Mortality as a result of spider bites is very low compared to snakebites, although there is a moderate morbidity (globally > 10,000 each year).

Some spiders are large. The record is held by *Theraphosa leblondi*, the Goliath bird spider from Guyana. A giant specimen had a body length of 10 cm, a leg span of 26 cm and fangs of 25 mm. Some species have a limited geographical range (e.g. *Atrax robustus* in a limited part of Australia, *Phoneutria nigriventer* in Brazil), yet others are quasi cosmopolitan. There have been repeated instances of spiders, originally endemic in one area accidentally being introduced into another area where they had not been naturally present. In 2003, there was a notorious incident where *Latrodectus mactans hasselti* (black widow) was accidentally introduced in Hasselt, Belgium. Knowledge about spider bites is limited and incomplete, given that bites are often not noticed immediately (including that of the black widow) or because the spider was not identified.

Spiders produce various types of silk for different purposes, such as for the web, winding

around prey or eggs, “droplines” to make possible a hasty exit, for dissemination (“balloon riding” via a filament that is carried along by the wind), as a nuptial gift. Fibroin and sericin are produced in separate silk glands. Not all spiders produce webs. Some hunting spiders rely on their vision and speed to capture their prey.



Spider anatomy. Adapted from original.

## Venom glands and venom

Most spiders have venom glands. The venom glands lie either in the chelicerae or at the front of the cephalothorax. The venom duct leads to the fangs, which are located at the end of the chelicerae. The venom is injected into the natural prey but is also used to defend against predators. After having killed the prey, the spider releases digestive juices over it and afterwards sucks up the liquefied mush. Spider venom has various purposes. Spiders which hunt, such as *Loxosceles* and *Phoneutria*, have neurotoxic / proteolytic toxins in their venom. Spiders which make webs generally have weaker venom, except for *Latrodectus*. Some bird spiders have urticarial hairs which, when lost by the animal, can irritate skin, conjunctivae and the mucous membrane of the mouth. Similar irritating hairs are also found in other animals, such as some caterpillars (e.g. procession caterpillar) and various adult butterflies.

# Species, clinical and treatment

## Loxosceles

*L. reclusa* (violin spider, brown recluse spider in North America) and *L. laeta* (South America) are the most familiar and notorious. They have a beige-brown colour with a dark spot in the form of an upside-down violin dorsally on the cephalothorax (the “violin” points to the rear of the abdomen). There are three pairs of eyes (dyads), one in front and the others on the sides. In nature they can be found under stones, logs, etc., but the animals also often enter houses and thrive in this environment (they are “synanthropic”). They are often found there in large numbers. In South America *L. laeta* is known as the “araña de los rincones” [“rincón” = corner], which refers to this peridomestic character. In so far as their psychology is understood, spiders only bite when they feel threatened. They live 1 to 3 years.




Loxosceles spider bite. The venom can provoke skin necrosis. Copyright Alexander von Humboldt Institute, Peru

The venom of *Loxosceles* sp. is primarily cytolytic and haemolytic.  Clinically, a bite results in initial pain followed by mild skin irritation. After 6 hours or so the pain intensifies. There are local vasospasms and ischemia develops. An itching oedema with a red halo and purple centre develops. A central bulla can form. This can evolve into a necrotic wound which nevertheless remains limited to the skin. A bite by *Loxosceles reclusa* can produce significant skin wounds, with necrosis and tissue loss. Underlying muscle tissue is not affected. A deep scar can remain. Occasionally there are systemic reactions with haemolysis and anaemia, clotting disorders, kidney failure and, in exceptional cases death. The patient can develop chills and fever, macular rash, joint pain, nausea and vomiting. Treatment is essentially

symptomatic. Tetanus prophylaxis must not be overlooked when local necrosis is present. When a patient is seen soon after a bite, dapsone 50-100 mg twice per day can be given, in order to limit the necrosis. It is best if G6PD-deficiency is excluded first. The efficiency of dapsone is not clear however. The wound should not be debrided too quickly (wait up to 2 weeks). Sometimes a skin graft may be necessary. When kidney failure or clotting disorders occur, the patient should be hospitalised. Anti-*Loxosceles* antiserum exists, but is usually not available.

## Latrodectus



Latrodectus hasselti. Australian black widow spider. Notice the red mark on the abdomen. Photo by Aart Noordam with special thanks to Arabel.



Latrodectus mactans. North American black widow spider. A red mark, sometimes diabolo-shaped, can be seen on her round ventral abdomen. Photo by Gilbert Loos with special thanks to Arabel.

These spiders, also known as black widows, have a very wide geographical distribution. The common English name refers to the habit of the female to eat the male after inseminating her. There are no natural wild populations of black widows in central and northern Eurasia (yet), although accidental introduction of exotic species occasionally happens. E.g. introduction in Belgium was first seen in 1967 in Tervuren, in 1999 *L. hasselti* was found in Bree (near Hasselt, of all places! What's in a name?) and another introduction (*L. mactans*) was detected in August 2009 in Antwerp. Specialists recognize *Latrodectus mactans* (North American black widow), *L. hasselti* (Australian black widow) and *L. m. tredecimguttatus* (Southern Europe, including Italy; South America; spiders carry several ("13") pigment spots). At least 3 other species exist. *L. mactans* often bears a typical red hourglass-shaped spot on the abdomen. Only bites by female black widows are potentially dangerous. The fangs of the male are too small to penetrate human skin. Australia has probably the highest rate of

latrodectism per capita in the world. Unlike loxoscelism, neurotoxicity plays a central role with latrodectism. The initial bite feels like a pinprick, but direct local tissue damage at the bite site is generally absent or insignificant. The venom contains several substances, the most important of which is alpha-latrodectin (= alpha-latrotoxin), a neurotoxin that triggers an increased release of neurotransmitter at nerve endings. This results in a presynaptic depletion of neurotransmitter vesicles. Acetylcholine, noradrenaline, dopamine, glutamate and enkephalin systems are all sensitive to the toxin. This release followed by depletion of acetylcholine at neuromuscular junctions leads to fasciculations and muscle spasms, followed by flaccid paralysis and risk of respiratory arrest.

Sometimes painful muscle rigidity (primarily abdominal -“pseudo-appendicitis”- but without the specific focal tenderness or rebound pain) can occur. Other symptoms are hypertension, sweating, tremor, headache, malaise, vomiting, fever, general weakness, patchy muscle paralysis (sometimes with ptosis), excessive salivation, photophobia and priapism. Mortality in published series varies from 5 to 12% but these numbers are likely to be an overestimate due to case selection.  Pets such as cats can easily be killed by female black widows.

Mild cases with limited signs and symptoms tend to resolve spontaneously over hours to days. The pain however can be very intense. If pain predominates, analgesics (including opiates) may be necessary and sometimes are insufficient. In more severe cases (usually within 12 hours, but sometimes up to days after the bite), benzodiazepines (diazepam) can be used against muscle spasms and to reduce the abdominal pain. Hypertension which does not improve after pain control sometimes requires the vasodilator IV nitroprusside or nifedipine. Antivenom can be given in serious cases, including priapism, but is rarely available. Full recovery might take several weeks. Respiratory or cardiac support is very rarely needed. Neostigmine for counteracting acetylcholine depletion has been proposed but never been proven to help.

## Atrax and other funnel-web spiders

In Australia there are 35 species of funnel-web spiders. They have a funnel-shaped web, often with triplines to detect their prey. *Atrax* species are large, aggressive spiders. The most notorious is the Australian *Atrax robustus* or Sydney funnel-web spider. The venom of the

spider includes a neurotoxin with potentially fatal consequences for humans. The fangs can be up to 5 mm long and can penetrate a fingernail. The spider makes its web under stones, logs, hedges, near vegetation and fences. Clusters of up to 150 animals have been found. With this species, the bite of the male spider is much more serious than that of a female spider and is justifiably highly feared. The venom includes the small protein robustoxin, a unique presynaptic neurotoxin. The venom interferes with the release of the neurotransmitters noradrenaline and acetylcholine at the level of the motor and autonomous nerves.

A bite by *Atrax* is followed by intense pain. This is probably due to the mechanical damage and the acidic pH (4.5) of the venom. No dermal necrosis results. In serious cases there follows a rapidly progressive neuromotor syndrome which can be fatal within two hours. Initially there is local piloerection and muscle fasciculation. These symptoms become generalised with tingling sensations around the mouth and tongue and lip spasms. Within a half hour they are followed by marked hypertension, tachycardia, 2nd degree AV block, hyperthermia, haemoconcentration and coma with increased intracranial pressure. Copious sweating, excessive salivation, lacrimation, diarrhoea and muscle cramps follow. Asphyxia can lead to death. If the patient survives, there follows hypotension and intermittent apnoea after one or two hours, possibly with pulmonary oedema. This too can be fatal. Muscle enzymes (CK) can rise substantially. Children are at higher risk than adults.

Shortly after a bite it is recommended that a splint and a lymphatic tourniquet (“pressure immobilisation technique”) should be applied. In this way the systemic resorption of the venom is slowed down and the patient can be transferred to a hospital. Antitoxin has been available in Australia since 1981 (Funnel Web Spider Antivenom, CSL, Australia). Oxygen, mechanical respiration with PEEP, atropine (against bronchorrhea and excessive salivation) and short-acting antihypertensives should be used depending on the symptoms. Since acute stomach dilatation can develop, nasogastric aspiration must be performed.

## Phoneutria

These aggressive South American spiders are nocturnal hunters which do not weave webs. They often hide in bunches of bananas, hence their popular name. *Phoneutria* is unusually

aggressive and tends to bite several times at the same site in quick repetition.

The venom is a complex mixture with several neurotoxic components. It acts on both the peripheral and the central nervous system. A bite is followed by sharp pain and then by tachycardia, hypertension, hypothermia, profuse sweating, excessive salivation, nausea and vomiting, priapism and dizziness. Death can occur within 6 hours and is generally attributable to respiratory arrest. A polyvalent antiserum (anti-Loxosceles and anti-Phoneutria) can be given through local infiltration and IV administration.

## Lycosa



Spider. *Lycosa tarantula*. Copyright ITM

Wolf spiders belong to the Lycosidae family. They are nocturnal hunters which generally do not spin webs. Earlier it was believed that they hunted in groups, hence the popular name. Wolf spiders include species with a moderately cytotoxic venom. The best known is the European tarantula (*Lycosa tarantula*). Its bite was earlier deemed to provoke tarantism in the victim, a syndrome characterised by stupor and a wish to dance. Possibly this refers to the consequences of *Latrodectus* bites, rather than *Lycosa* itself, since the latter only causes local pain, swelling and erythema. Tetanus vaccination, painkillers and local disinfection suffice for bites by these animals.

## Bird spiders and their relatives

“Bird spiders” belong to several genera. Some people keep them as “pets” although several species are protected under the CITES convention (Convention on International Trade in Endangered Species). Several American genera of bird spiders have fine urticarial hairs. The density amounts to 10,000 fine hairs/mm$^2$. When the animals feel threatened they rub with their legs over their back, detaching the fine urticarial hairs which are armed with small barbs. These can be released by the thousands and cause persistent itching when they come into contact with the skin and work their way under the surface. Penetration into the cornea or inhalation can lead to serious consequences. When handling these animals, wear gloves and safety glasses, avoid rubbing your eyes and wash carefully after manual contact. Bites by these spiders cause local pain and swelling, whether or not followed by lymphangitis. The treatment is symptomatic. Beware of the fact that urticarial hairs are also present on exuvia (shed skin), even when preserved in alcohol!

## Chiracanthium

*Chiracanthium* species are notorious for their annoyingly painful bites. A bite is followed within 30 minutes by local itching and redness. Sometimes this can evolve to local necrosis. Systemic effects include (rather rare) nausea and abdominal pain, as well as headache. The treatment is symptomatic. Besides black widows and wolf spiders, the only European spiders which should really be handled carefully are *Chiracanthium* species (Clubionidae) and the water spider *Argyroneta aquatica*.


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Residual erythema after Chiracanthium spider bite. Copyright ITM