

MEDICAL AND VETERINARY ENTOMOLOGY

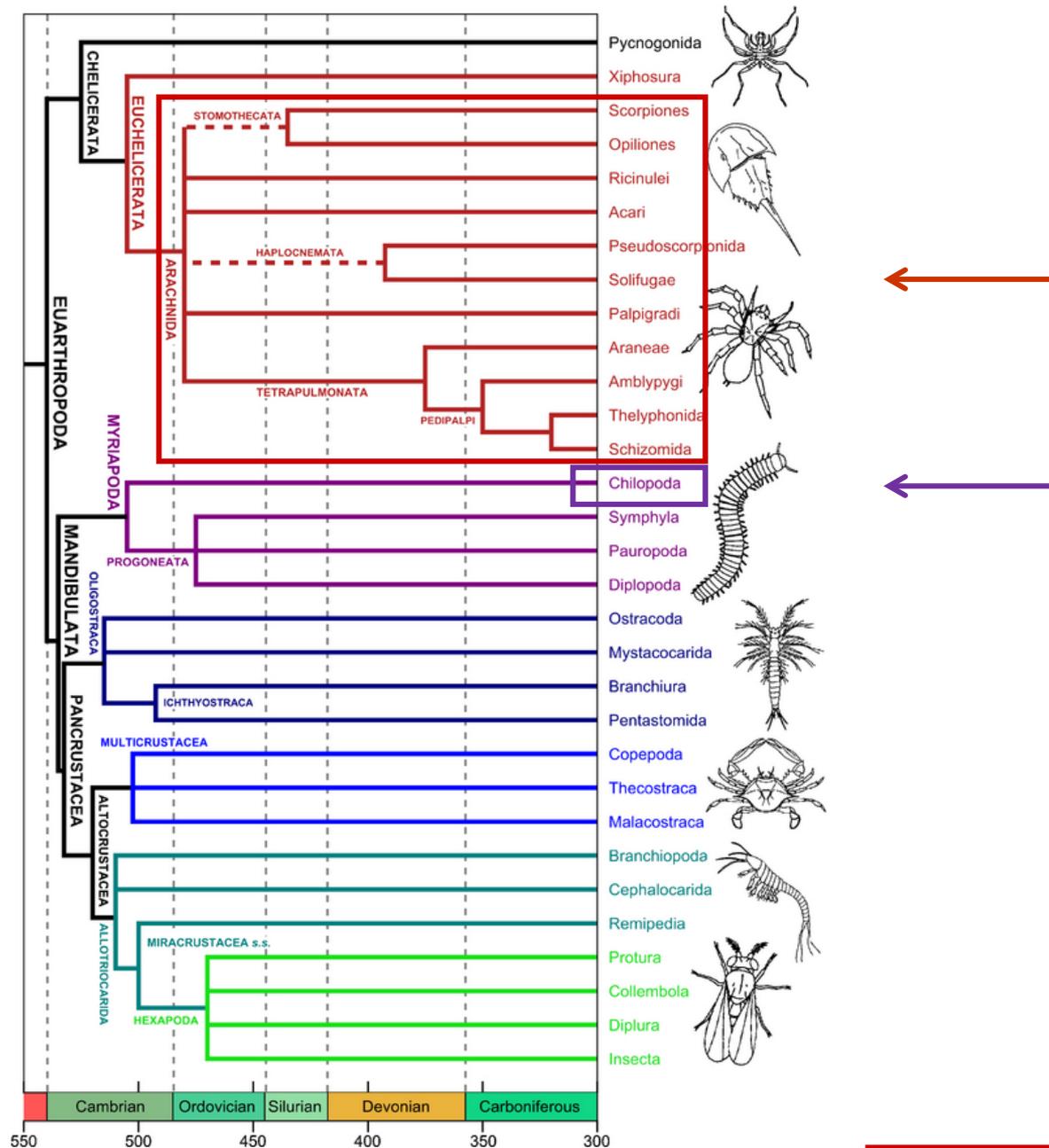
CHILOPODA

&

ARACHNIDA

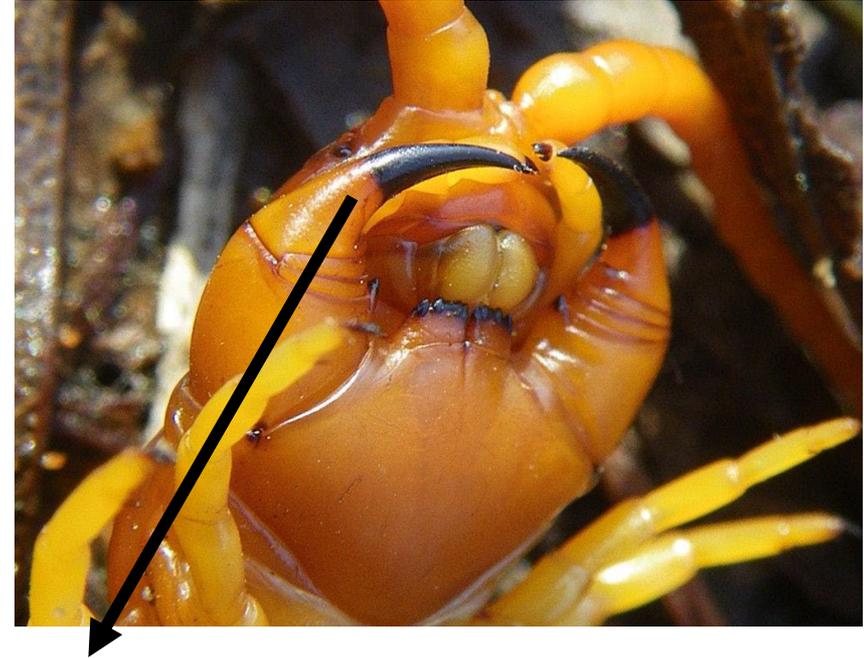
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Class Chilopoda - Centipedes

- old group (fossils about 400 Mya), 30 to 354 legs, predators
- ~ 3000 species (8000)



Forcipules – the first pair of legs with a poisonous spine

A 19th-century Tibetan poet warned his fellow Buddhists "if you enjoy frightening others, you will be reborn as a centipede"

Class Chilopoda - Centipedes



- Only a small number of species can bite humans or larger animals
- The most dangerous species are tropical
- Poisonous bite: nuisance, allergies
- Bites are painful and can cause urticaria, especially dangerous for children (but rare!)
- The toxicity and composition of the poison are poorly known (histamines, proteases, esters, serotonin, cardiac inhibitor toxin S)
- Rare cases of anaphylaxis associated with previous allergies to wasps and bees



Scutigera sp.



Scolopendra heros

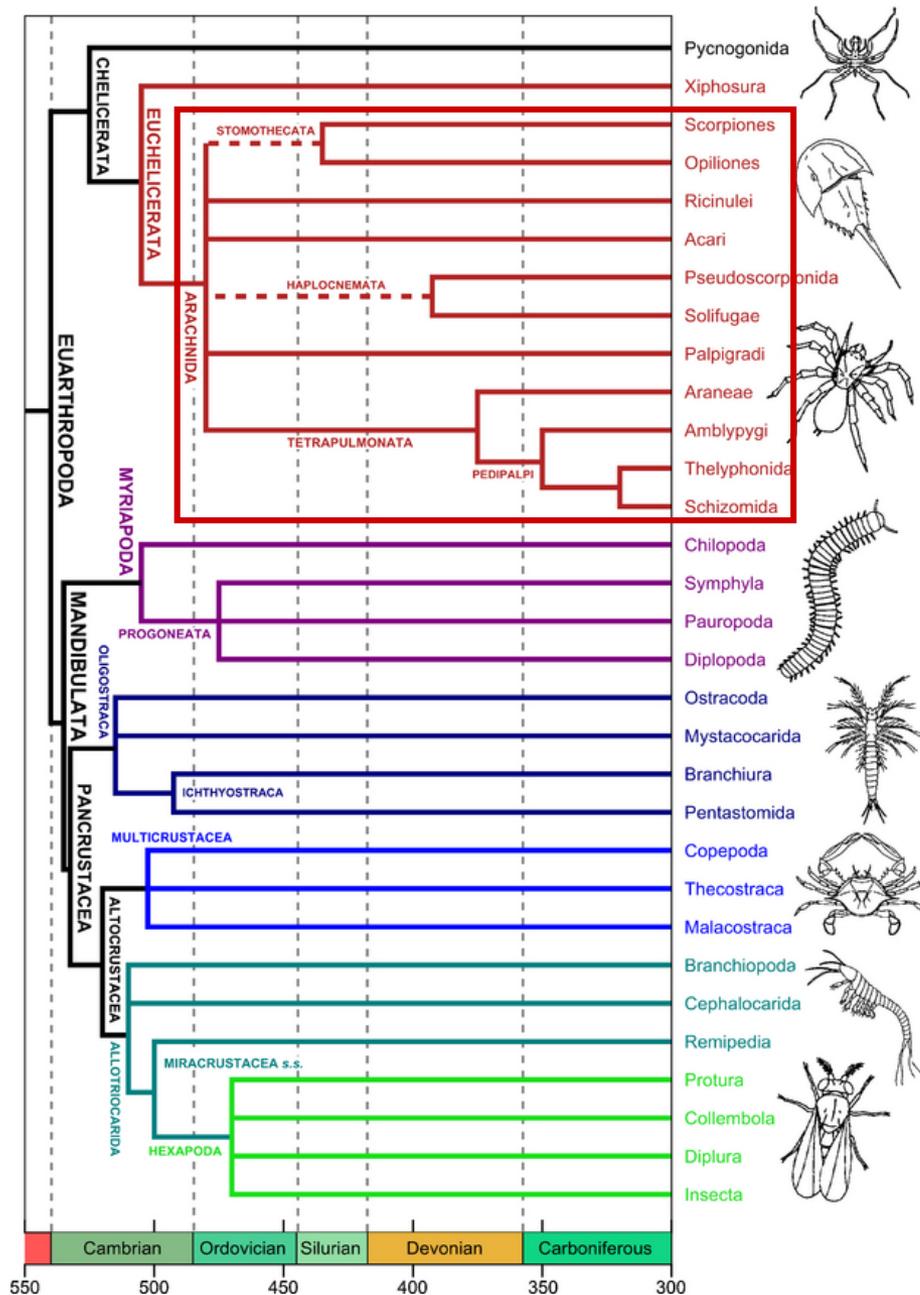
Class Chilopoda - Centipedes

**In Croatia, 80-90 species,
3 species described from
caves**

***Geophilus hadesi* in Luka's cave at
-980 m. foto: J. Bedek**

Stoiev et al., 2015, ZooKeys





World Arachnida Catalog

<https://wac.nmbe.ch/>

World Spider Catalog (WSC)

<https://wsc.nmbe.ch/>

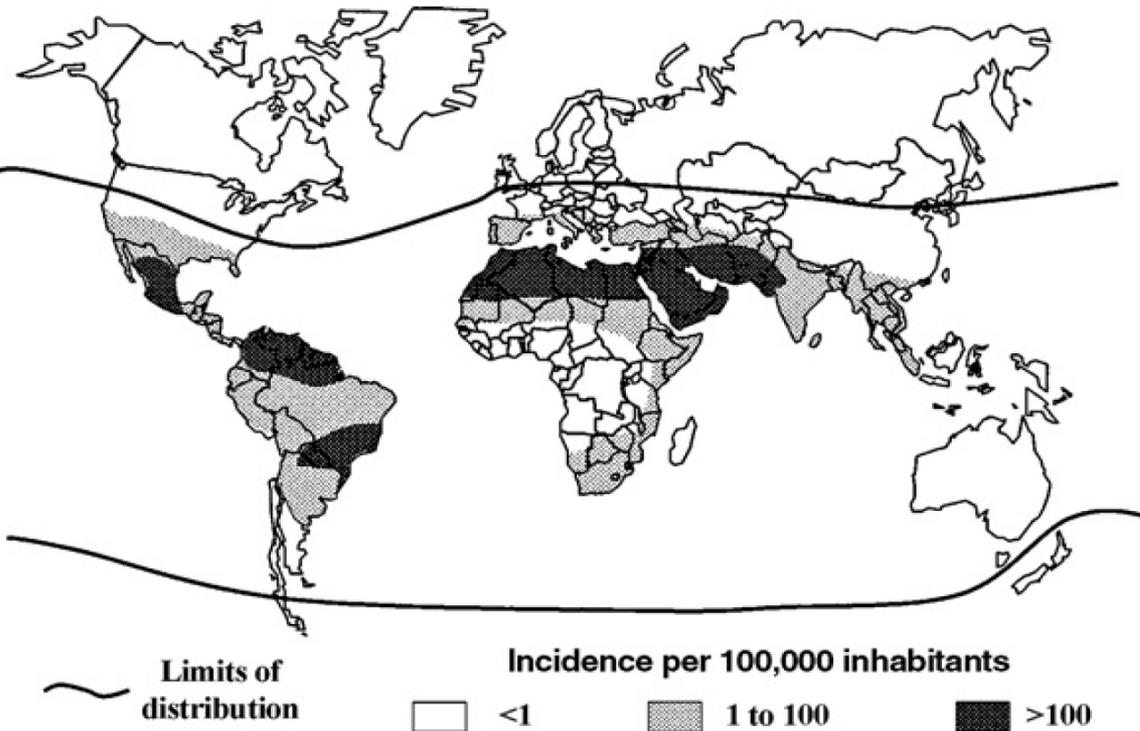
Class Arachnida



- Order Scorpiones – Scorpiones
- ~2500 species of scorpions, fossils in the Silurian
- Mostly benign, mythology
- All are predators, in the telson there is a poisonous gland, an "empty" sting
- < 50 species of medical importance (25), almost all from the family Buthidae (90%)
- The toxicity of the poison and the reaction to the toxin itself depends on the age of the person (children), individually, the amount of poison, but not on the size of the scorpion



- Order Scorpiones – Scorpiones
 - Tropical and subtropical areas
 - Very well adapted to dry climatic conditions
 - Mostly active at night; soil, canopy



Distribution of scorpions in the world

Species dangerous to humans

Genera	Species	Distribution	
Old World	<i>Androctonus</i>	<i>aeneus</i>	Africa, North of Sahara, Saharan oases and African Sahel
		<i>australis</i> ^a	From Algeria to Egypt, Saharan oases
		<i>crassicauda</i>	From North Africa to Saudi Arabia and Turkey
		<i>mauretanicus</i> ^b	Morocco
		<i>hoggarensis</i>	Saharan mountains
	<i>Hottenta</i>	<i>franzwernerii</i> ^b	Morocco
	<i>Buthus</i>	<i>tamulus</i>	India
		<i>occitanus</i>	East Mediterranean basin and African Sahel
	<i>Leiurus</i>	<i>quinquestriatus</i> ^a	Africa, Middle-East
	<i>Parabuthus</i>	<i>granulatus</i>	South Africa
<i>transvaalicus</i>		South Africa, Zimbabwe	
<i>villosus</i>		South Africa, Namibia	
<i>Hemiscorpius</i>	<i>liosoma</i>	Saudi Arabia	
	<i>lepturus</i>	Iran, Iraq	
	<i>Mesobuthus eupeus</i>	Turkey, Caucasus, Iran, Afghanistan	
New World	<i>Centruroides</i>	<i>exilicauda</i> ^a (= <i>sculpturatus</i>)	South of the United States
		<i>infamatus</i>	South of the United States, Mexico
		<i>elegans</i>	Mexico
		<i>noxius</i>	Mexico
		<i>suffuses</i>	Mexico
		<i>limpidus</i>	Mexico
		<i>gracilis</i>	Colombia
	<i>Tityus</i>	<i>pachyurus</i>	Colombia
		<i>trinitatis</i> ^b	Trinidad
		<i>discrepans</i>	Amazonian basin
		<i>cambridgei</i>	Amazonian basin
		<i>caripitensis</i> ^b	Venezuela
		<i>surorientalis</i> ^b	Venezuela
		<i>arellanoparrai</i> ^b	Venezuela
		<i>bahiensis</i>	Brazil
		<i>brazilae</i>	Brazil
		<i>serrulatus</i>	Brazil
		<i>stigmurus</i>	Brazil
<i>trivittatus</i> ^a	Argentina		



- Order Scorpiones – Scorpiones
 - Sting site (up to several hours): pain, swelling, redness, formation of water blisters, in severe cases bleeding, necrosis, joint pain
 - Systemic: nausea, pain, rapid breathing, dizziness, numbness of the face and throat—everything more or less stops in a few hours (12)
 - In a very small number of species (neurotoxins), serious problems occur, such as respiratory and cardiovascular problems, convulsions (abnormal electrical outbursts in the brain), mental confusion, sweating, ..., can cause death (after a few days), most often by cardiac arrest



Leirus quinquestriatus
(North Africa, Middle East)
LD₅₀ = 0.25mg/kg



Tityus serrulatus
(Brasil) LD₅₀ = 0.43mg/kg



Centruroides limpidus
(Mexico) LD₅₀ = 0.69mg/kg

Class Arachnida

- Order Scorpiones – Scorpiones
 - The venom is complex and variable, mostly consisting of neurotoxic peptides (long and short) and hemolytic substances (disintegration of erythrocytes)
 - The influence of poisons on sodium channels in the membrane of cells in the neuromuscular system, inactivation of closing sodium channels, binding to K and Ca channels—among the strongest poisons in general!
 - The injection site does not need to be treated with anything (ice), no drugs, but analgesics and pain relief (eg. in China *Mesobuthus martensii*), cancer, autoimmune diseases
 - Antidotes available only for a few species, highly specific and must be given within 1 hour of the sting, can cause allergic reactions



Class Arachnida

- Order Scorpiones – Scorpiones
 - 12 species in Croatia, Europe 100 (GR)
 - There are no recorded deaths in Hr;
 - DNA, great diversity



Mesobuthus eupeus



Euscorpis italicus



© Marshal Hedin



Euscorpis carpathicus



Class Arachnida

- Order Solifugae – Nightshades
- < 1000 species
- Most tropical and subtropical, most often come out at night, fast runners
- Adapted to dry conditions, southern Europe (Italy, Greece, Macedonia)
- Predators, very fast and aggressive, use strong pincers for hunting, pedipalps are enlarged and look like the 5th pair of legs, they have no poisonous glands!
- Medical importance primarily due to potential wounds and secondary infection (gangrene, necrosis, ...)



Class Arachnida

- Order Solifugae – Nightshades



Class Arachnida

- **Order Araneae – Spiders**
- **> 50,000 described species (WSC), > 800 species live in Croatia**
- **They live in all regions of the world, they are all predators**
- **The poison is primarily used for defeating the prey and for defense**





- **Order Araneae – Spiders**

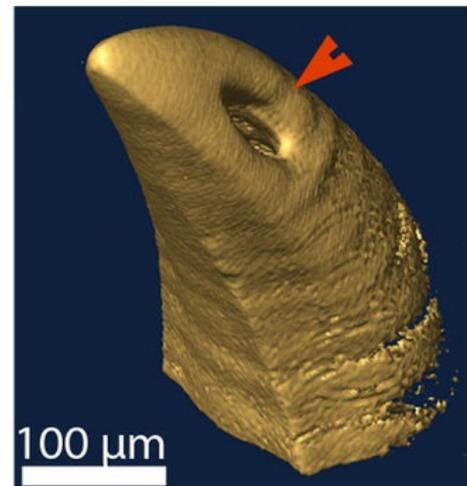
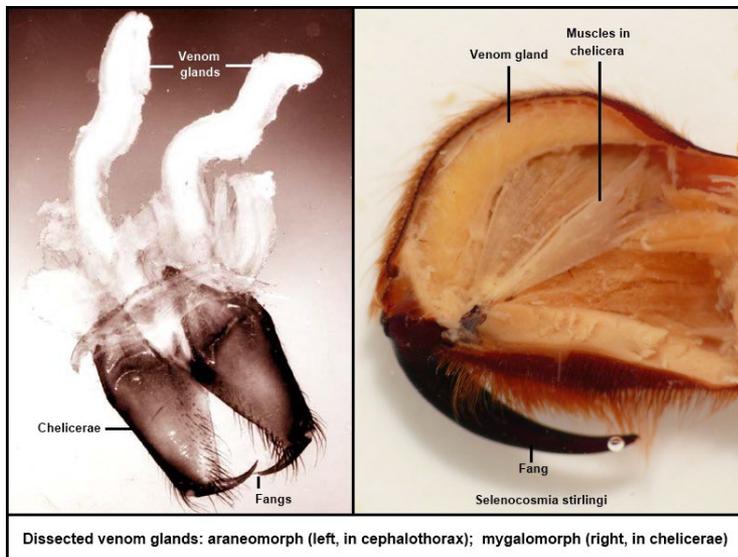
- > 50000 described species (WSC), > 800 species live in Croatia
- They live in all regions of the world, they are all predators
- The poison is primarily used for defeating the prey and for defense
- Generalists (larger glands, more complex venom composition) and specialists (smaller glands, simpler venom)



Class Arachnida

• Order Araneae – Spiders

- Almost all spiders in the world are poisonous! (except the families Symphytognathidae and Uloboridae)
- They are used with poison from poisonous glands whose openings are in the spines of the pincers (chelicerae), the glands themselves mostly in the prosoma and base of the pincers.
- < 60 species are medically important, mostly tropical and subtropical
- Medical importance related to the composition of the poison and the strength of the body's reaction due to various toxins

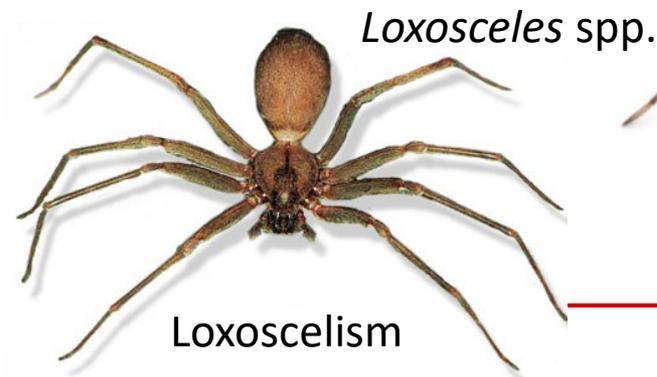
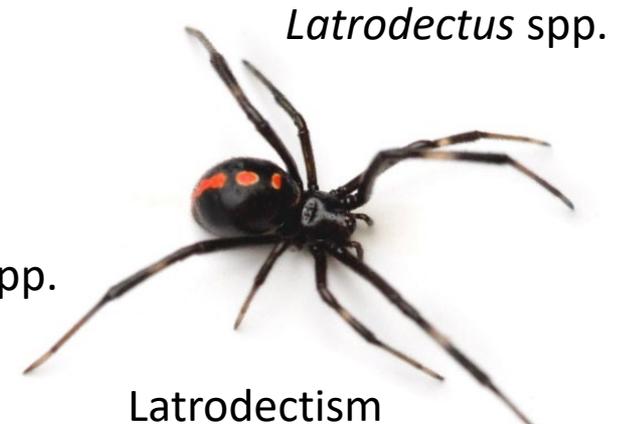


Class Arachnida



• Order Araneae – Spiders

- The venom is complex and highly variable, especially between different genera and species (proteases, esterases, polyamines, amino acids, histamines and specific toxins)
- Neurotoxic and cytolytic toxins in addition to histamines, serotonin (causes intense pain by contraction of smooth muscles around blood vessels), ...
- Most medical cases related to secondary infections
- Due to the different categories of poisons, symptoms and conditions are defined depending on the species/genus that caused the reaction





Class Arachnida

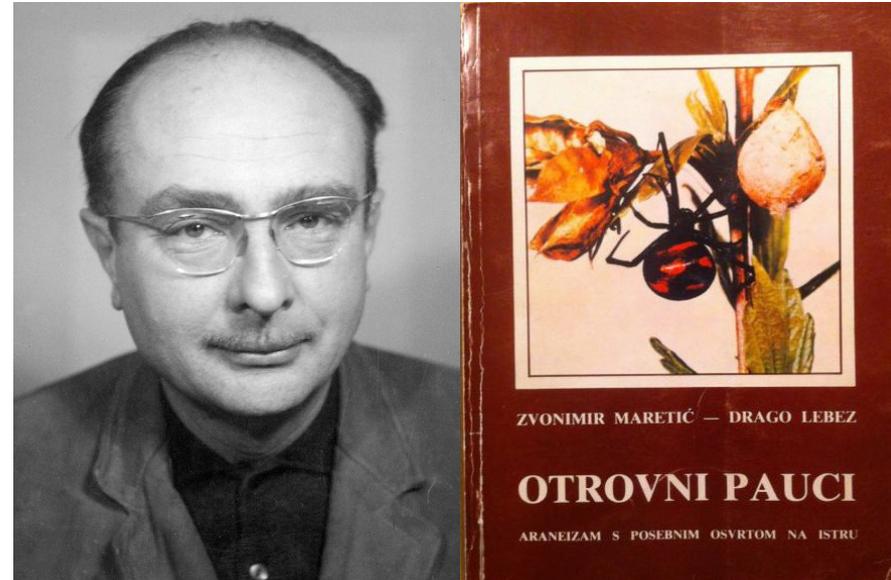
- Order Araneae – Spiders
- Latrodectism
- *Latrodectus* spp. (Theridiidae) – black widows and related species (34)
- The venom contains α -latrotoxin, which is a strong neuromuscular toxin and causes pain, tremors, nausea, vomiting, dizziness, sweating (especially at the bite site), spasms, muscle weakness, stiffness, paralysis, inability to speak, ..., breathing problems (suffocation) – can last up to 48 hours
- α -latrotoxin acts on nerve endings in neuromuscular junctions



Distribution of black widows in the world

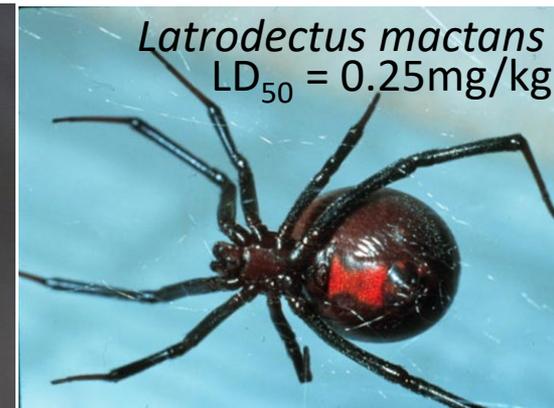
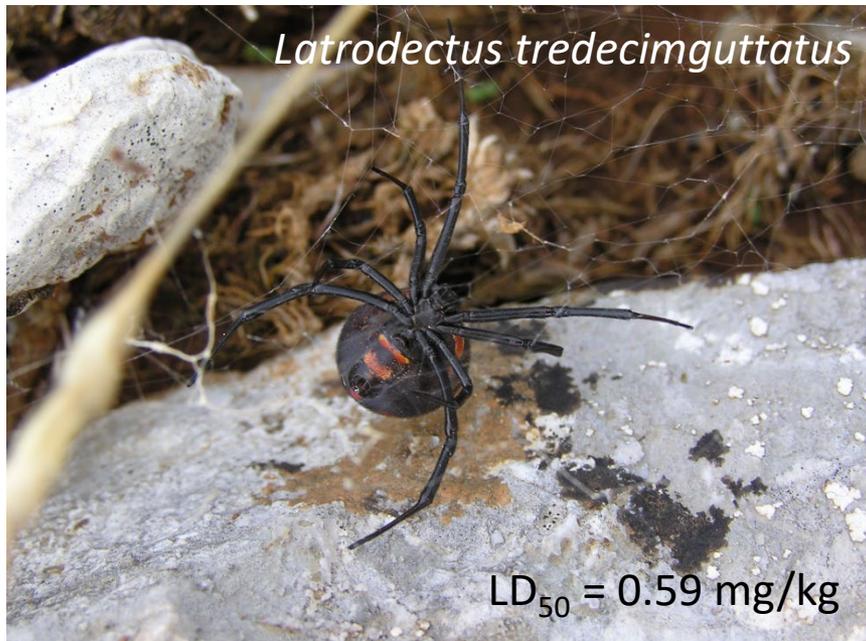
Class Arachnida

- Order Araneae – Spiders
- Latrodectism - *Latrodectus* spp. (family Theridiidae)
 - Mortality relatively low (~ 5 %) even in untreated cases
 - There is an antidote for most species, including *L. tredecimguttatus*, the European black widow - Zvonimir Maretić (1921-1989)
 - Calcium gluconate was previously used to relax the muscles in bites, today it is considered to have no effect



Class Arachnida

- Order Araneae – Spiders
- Latrodectism - *Latrodectus* spp. (family Theridiidae)
 - Outbreaks of black widow epidemics (eg. *Latrodectus tredecimguttatus*) recorded in Russia and Spain in the 19th century
 - Impact on livestock (when grazing grass), mortality in cattle up to 12%, in sheep up to 17%
 - Cats are particularly sensitive to poison



Class Arachnida

- Order Araneae – Spiders
- Latrodectism
- *Latrodectus tredecimguttatus* – black widow
 - Frequent bites in history, in the field, 1998 - 2009. 47 bites in HR
 - Mortality is rare today - a total of 2 recent deaths
 - Antidote - improvement of the condition in a few minutes, healing in three hours, without serum recovery after a few weeks
 - Zvonimir Maretić – the first serum in Europe in the 1950s!
 - Folk medicine:

Sealing in a warm bread oven

Burying in hot earth

Dance until exhaustion

Large amounts of alcohol

Crucifixion and swinging on ropes

9 namesakes sway for 9 days

Find the culprit spider and burn down the house

...



U kabinetu dr. Maretića

Class Arachnida

- Order Araneae – Spiders
- *Latrodectus tredecimguttatus* – Black widow
- Mediterranean to China, annual, adults 6 to 10 months, in hiding
- Dry habitats, maquis, thickets, active at night
- Along and under stones and stumps, in the grass, next to houses, sheds, greenhouses
- Various coloring

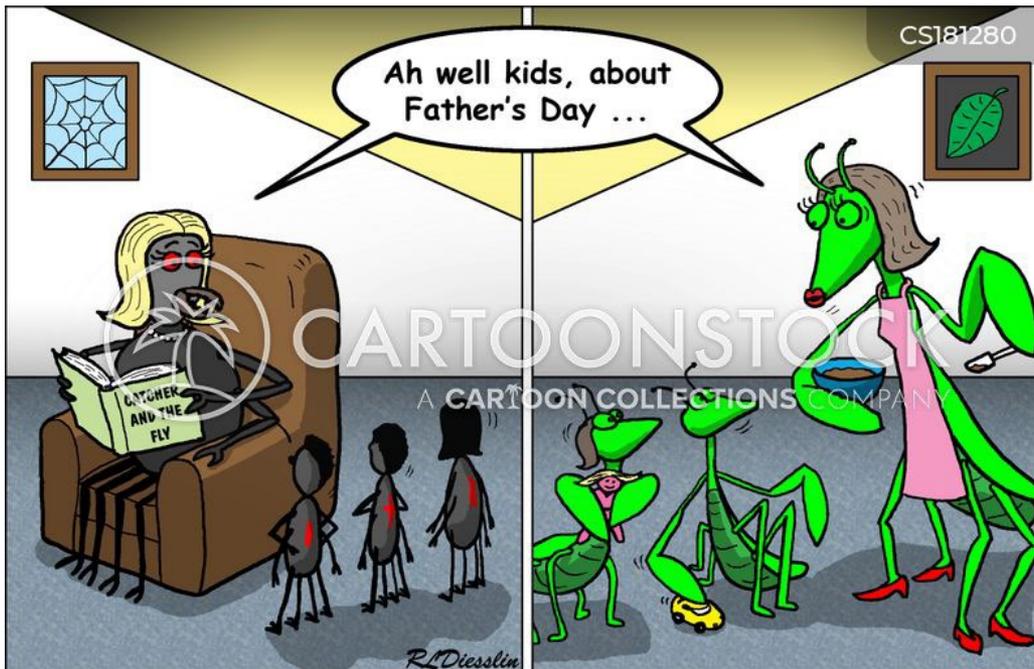


Latrodectus tredecimguttatus



Class Arachnida

- Order Araneae – Spiders
- *Latrodectus* spp. (family Theridiidae)
 - Sexual dimorphism, males much smaller than females
 - Males of some species sacrifice themselves voluntarily, in some they share the web



Latrodectus mactans

Class Arachnida

- Order Araneae – Spiders
- Tarantism
- *Lycosa tarentula* – "Tarantula"
- Taranto (Italy) 1370 epidemic of Tarantism (Aristotle, Middle Ages)
- The bite reportedly leads to tremors, hyperactivity, difficulty breathing, muscle stiffness, priapism (prolonged and unwanted erection), sweating and uncontrollable crying
- Remedy: dance until exhaustion (organized), 3-4 days
- Tarantella – traditional Italian dance and melody
- In reality, the bite is a little painful and there is slight swelling around the bite itself

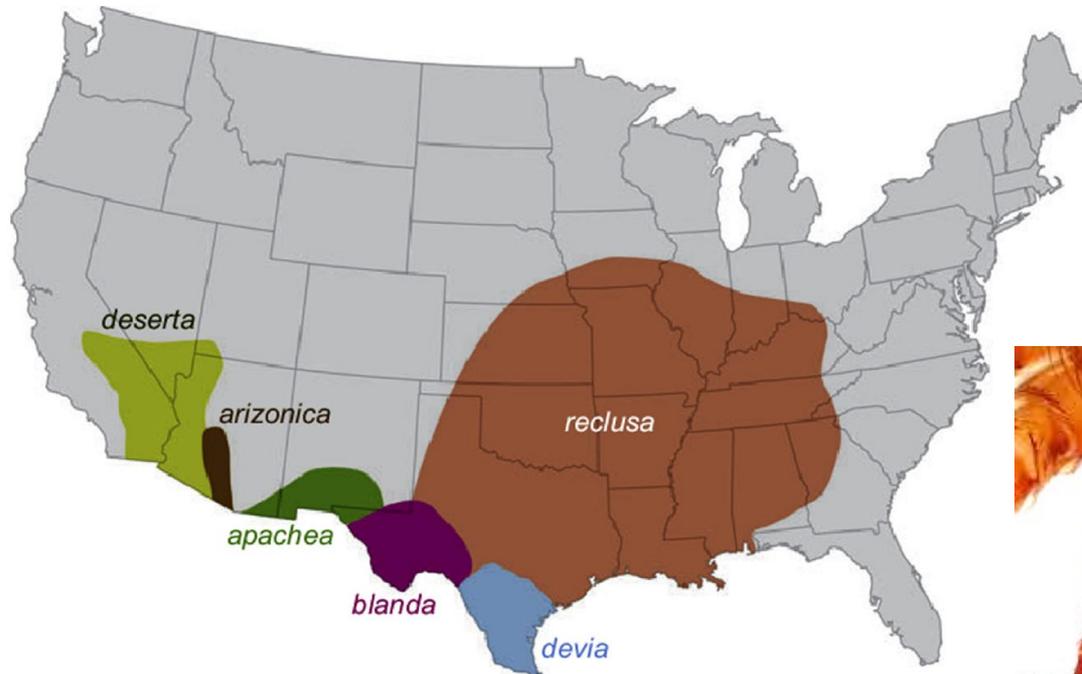


latrodectism?



Class Arachnida

- Order Araneae – Spiders
- Loxoscelism
- *Loxosceles* spp. (Sicariidae), recluse or violin spiders (143 species)
- Most species (80%) related to North and South America (Neoarctic and Neotropis) where they enter houses - *Loxosceles laeta*, *Loxosceles reclusa*
- *Loxosceles rufescens* – present in southern Europe, but also throughout the world (transmitted)



Loxosceles reclusa





Class Arachnida

- Order Araneae – Spiders
- Loxoscelism
 - *Loxosceles* spp. (Sicariidae)
 - It is the only proven type of necrotic arachnidism in humans
 - Cytolytic components of venom, phospholipase D are enzymes that cleave fatty acids - sphingomyelinase D is an enzyme that destroys sphingomyelin in cell membranes
 - The reaction is local and tissue damage is usually proportional to the amount of poison injected, the bite site is NOT PAINFUL, 2-3 h
 - Healing takes months, especially if it is a bite where there is a lot of fatty tissue - scars



Loxosceles laeta (Južna Amerika)



Loxosceles reclusa (Sjeverna Amerika)

Class Arachnida

- Order Araneae – Spiders
- Loxoscelism
 - *Loxosceles* spp. (Sicariidae)
 - Misdiagnosis often occurs, given that the spider is rarely seen at the time of the bite (bites often occur at night)
 - Severe cases are rare, as are secondary infections
 - Systematic reaction of the body is rare - almost exclusively in children and can be fatal - hemolytic anemia, coagulation, kidney failure
 - There are antidotes (JA), the treatment is usually cleaning the wound, rarely corticosteroids, excision of the wound after it stops spreading (acceleration healing)





Class Arachnida

- Order Araneae – Spiders
- Loxoscelism
 - *Loxosceles* spp. (Sicariidae)
 - *L. reclusa* is common near people, it likes a dry and warm habitat, so it enters houses, garages, closets..., but hides
 - active at night, encounters are accidental when a person lies down or otherwise "pinches" a spider that defends itself with a bite
 - the bite is usually not felt (only sometimes), the person starts to feel the pain about 2-3 hours later, the pain usually gets a little worse every day
 - 90% of bites are harmless, but 10% of severe cases are highly publicized



<https://twitter.com/recluseornot>

Class Arachnida

- Order Araneae – Spiders
- Loxoscelism
 - *Loxosceles rufescens*
 - Native to the Mediterranean, transported around the world near human settlements, dry and hidden places, warm caves



Loxosceles rufescens

© S. Dréjean



Class Arachnida

- Order Araneae – Spiders
- Phoneutrism
- *Phoneutria* spp. (Ctenidae) – wandering spiders, "banana spiders"
- Present in South America
- Aggressive and large spiders
- The most dangerous species: *Phoneutria nigriventer* i *Phoneutria keyserlingi*





Class Arachnida

- Order Araneae – Spiders
- Phoneutrism
 - *Phoneutria* spp. (Ctenidae) – wandering spiders, "banana spiders"
 - Frequent bites, most very mild symptoms (90%), but can have a strong impact on the central and peripheral nervous system
 - The bite is very painful, the venom causes drooling, sweating, muscle spasms, painful penile erections, vision problems
 - Peptide neurotoxins that act on Na⁺ channels, histamine, serotonin
 - Deaths are associated with lung collapse, respiratory failure





Class Arachnida

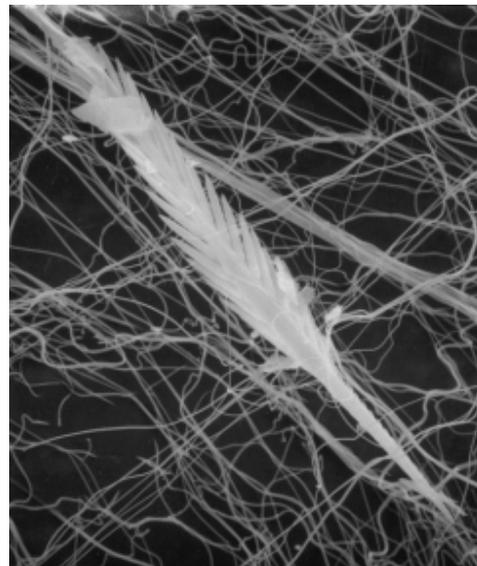
- Order Araneae – Spiders
- Tarantulism
- Porodica Theraphosidae – tarantulas
- Most species are weakly poisonous, the bite mostly similar to a wasp or bee sting
- underground tunnels, during mating the males move more when they are quite aggressive; venom evolved to be effective for vertebrates
- Dangerous species in South America, Africa and Australia
- The venom contains necrotoxins, neurotoxins and hemolytic substances
- For example the bite of the African species *Harpactirella lightfooti* causes intense pain, vomiting and can lead to shock and collapse





Class Arachnida

- Order Araneae – Spiders
- Tarantulism
 - Family Theraphosidae – tarantulas
 - Many of them have defensive urticarial hairs (0.2-2 mm) on the opisthosoma and can scrape them with their hind legs (1 million hairs per individual); N and S America; and species sold as pets
 - Can cause severe urticaria lasting several weeks (only mechanical irritation), sensitive eyes, respiratory system





Class Arachnida

- Order Araneae – Spiders
- Atraxism
- Genera *Atrax* and *Hadronyche* (Atracidae)
- Eastern Australia – 6 highly poisonous species
- Sydney recluse spider (*Atrax robustus*) - ♂ up to 5 cm
- Wandering males in the mating season are aggressive and come near houses



Class Arachnida



- Order Araneae – Spiders
- Atraxism
 - Genera *Atrax* and *Hadronyche* (Atracidae)
 - *Hadronyche* rarer, but more dangerous bites
 - The bite causes sharp pain and a series of neurological disorders such as agitation, anxiety, hypertension, muscle twitching, irregular heartbeat, as well as pulmonary edema and intravascular blood clotting.
 - d-atracotoxin poison - affects the release of the neurotransmitter acetylcholine, which has a direct effect on the autonomic nervous system
 - Mortality in children common until antidote appeared
 - Research on the impact on heart function



Class Arachnida

Other species:

Cheiracanthium spp. – rare encounters, bite (accidental) similar to a wasp or bee sting, 5 species in Croatia

Family Agelenidae – common in houses

Eratigena agrestis

Native to Europe, introduced to America

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