

# Lékařská entomologie (Medical Entomology) 2022

Tuesdays from 9:50 to ~12:15

1. Toxic arthropods, soft ticks (Argasidae)	1.3
2. Hard ticks (Ixodidae)	8.3
3. Other parasitic mites (Mesostigmata, Prostigmata, Astigmata)	15.3
4. Lice and chewing lice (Pthiraptera), true bugs (Heteroptera)	22.3.
5. Fleas (Aphaniptera = Siphonaptera), Diptera, Nematocera I	29.3.
6. Diptera, Nematocera II	5.4.
7. Diptera, Brachycera	12.4.
8. Výběr a vyhledání hostitele, příjem krve (doc. Jovana Sádlová)	19.4.
9. Příjem a trávení krve (JS)	26.4.
10. Interakce patogen-vektor-hostitel (JS)	3.5.

Zkouška (písemný test, Út od 10:00), 3 termíny dle dohody, např. 17.5., 31.5., 14.6.

Studijní materiály a literatura v pdf (Lehane 2005, Service 2012) na dvou místech:

Moodle: <http://dl2.cuni.cz/course/view.php?id=383#section-0>

► [Sekce biologie](#) ► [Katedra parazitologie](#) ► [MB160P26](#)

[http://web.natur.cuni.cz/parasitology/vyuka/LekEnt\\_CV/](http://web.natur.cuni.cz/parasitology/vyuka/LekEnt_CV/)

# Ecdysozoa: Panarthropoda

Onychophora, Tardigrada

## Euarthropoda (syn. Arthropoda = phylum)

Arthropods: exoskeleton, cuticle, chitin, jointed limbs

Fosile: Trilobitomorpha

Chelicerata: 1st pair of legs = chelicera,  
2nd = pedipalpi

parasitic mites „Acari“ (subfamily)

toxic: spiders Aranea and scorpions Scorpiones (orders)

Mandibulata

Myriapoda: toxic Chilopoda

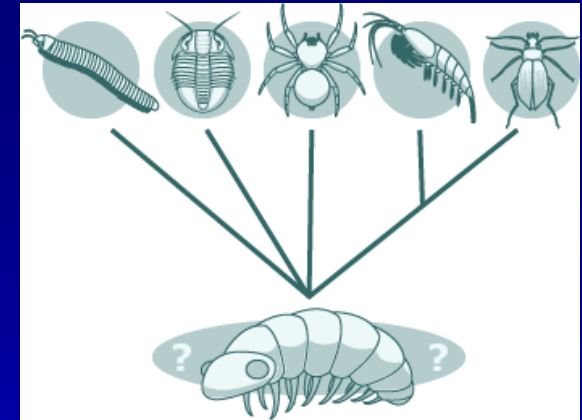
Pancrustacea: two subphyla Crustacea and Hexapoda

basal: parasitic Branchiura, Pentastomida

crustaceans: parasitic Copepoda, Cirripedia

Hexapoda: Endognatha, Ectognatha

Ectognatha = Insecta (class): toxic and parasitic

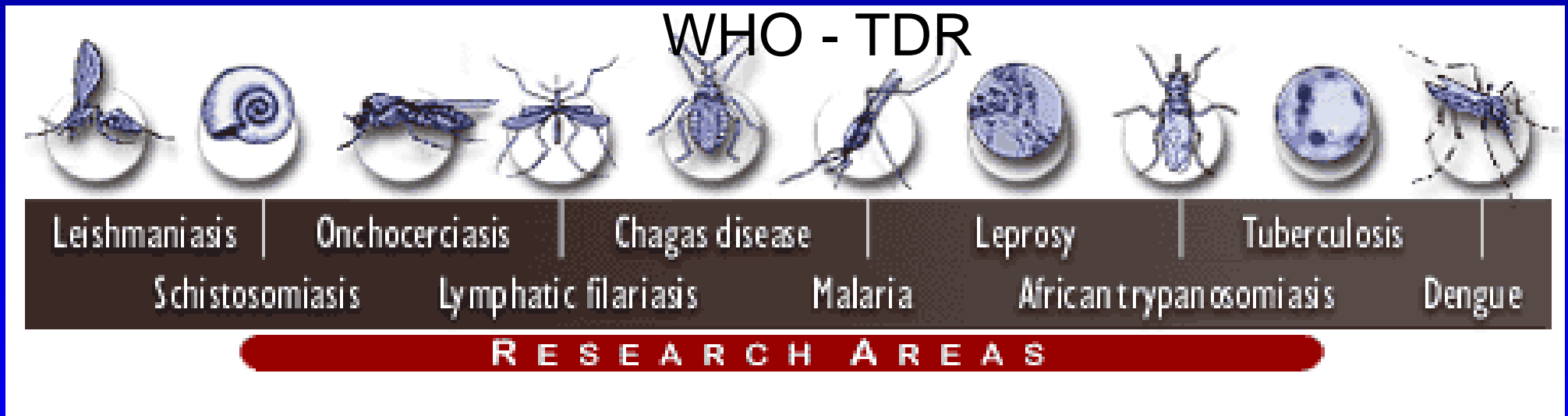


# Importance of parasitic arthropods

Bites: nuisance, hypersensitivity, economical impact,  
examples of black flies in Siberia (work outside), biting midges in  
Scotland (tourists), warble flies in cattle.

Different tolerance: native versus tourists.

Vectors: the most important diseases of tropics and subtropics are transmitted by  
bloodsucking arthropods.



20                      10                      100                      20                      400                      > 0.5                      50

Estimated human prevalence in milion cases

In additon, high economical loss due to diseases od domestic animals,  
mainly due to *Trypanosoma*, *Cowdria*, *Babesia*

## Investigations of vector-borne diseases

1868	A.P. Fedčenko	<i>Dracunculus</i> in crustacean (Copepoda)
1878	P. Manson	<i>Wuchereria</i> development in mosquito
1893	T. Smith	<i>Babesia</i> transmitted by <i>Boophilus</i> ticks
1895	D. Bruce	trypanosomes and tsetse flies
1897	R. Ross	bird plasmodia transmitted by <i>Culex</i> mosquitoes
1899	G.B. Grassi	human plasmodia transmitted by <i>Anopheles</i>
1901	W. Reed	yellow fever and <i>Aedes</i> mosquitoes
1909	C. Chagas	<i>Trypanosoma cruzi</i> and triatominae bugs
~1910	H.T. Ricketts	Rocky Mountain spotted fever and <i>Dermacentor</i> ticks
~1915	Prowazek, Rocha-Lima	epidemic typhus and <i>Pediculus</i> louse
~1928	Adler, Shortt	<i>Leishmania</i> transmitted by sand flies
1982	W. Burgdorfer	Lyme disease is a tick-borne borreliosis



# Toxic spiders (Araneida)

## Mygalomorphae (Orthognatha), funnel web spiders

*Atrax robustus*: western coast of Australia, Sydney funnel web spider, both sexes are toxic, night migration of males, aggressive, painful bite, male toxin 6x more powerful. Hyaluronidase and neurotoxins (d-atracotoxin: continuous acetylcholin release).

Primates are very sensitive

Dangerous for Children !

Respiratory failure,  
hypotension, death  
in 30-90 min.

No effect: rats, rabbits, cats

Antiserum available.





# Mygalomorphae (Orthognatha): Toxic spiders as pets

Hairs may cause allergy

*Poecilotheria*:

India, 7-8 cm, on trees,  
aggressive, prey on birds.  
Painful bite, possibility of  
anaphylactic shock



[http://commons.wikimedia.org/wiki/File:Poecilotheria\\_metallica](http://commons.wikimedia.org/wiki/File:Poecilotheria_metallica).



*Haplopelma*: cca 6 cm, South-west Asia, on ground, aggressive, fast, painful bite





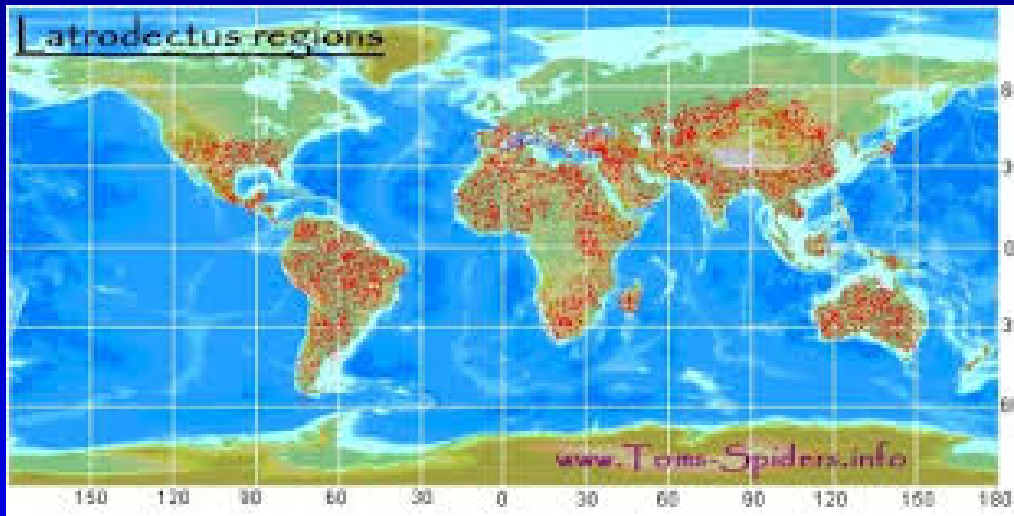
# Araneomorphae (Labidognatha) „true spiders“

## Theridiidae (*snovačkoviti*)

Black widow = neurotoxin, only females dangerous

*Latrodectus tredecimguttatus*: Mediterranean area, *L. geometricus*: South Africa

*L. mactans*: both Americas, very few death cases, other species around the world

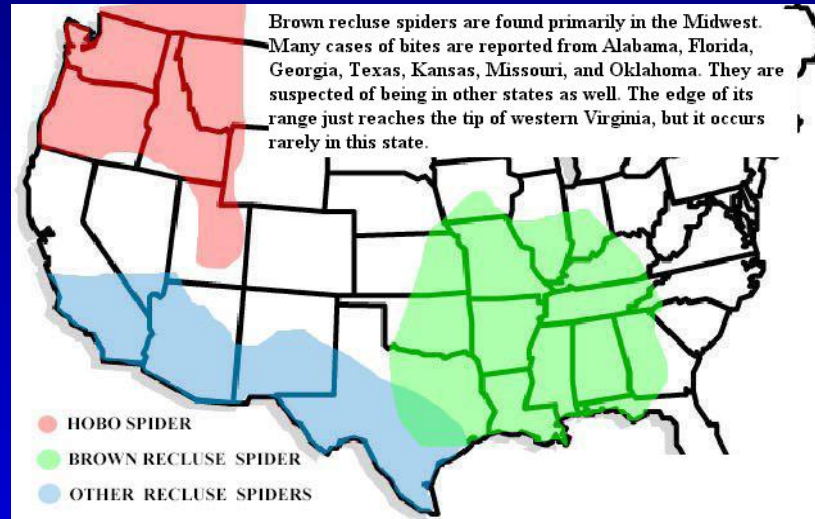


# Araneomorphae (Labidognatha): *Loxosceles reclusa*

Brown recluse spider: 6-20 mm, together with relative species present in USA.

Other similar species in Latin America.

Hemolytic and necrotic toxin: effect slow but lasts for a long time: cutaneous lesions and ulcers.





# Toxic spiders in Czech republic

*Chiracanthium punctorum* (zápřednice)



*Lycosa singoriensis*  
(slídák tatarský, „tarantule“)





# The most toxic scorpions of the Old World (Buthidae)

*Androctonus australis*  
(yellow fat tail scorpion):  
northern Africa, very  
painfull, some populations  
very toxic, mortal cases  
every year. Related species  
in Africa and Asia.



*Parabuthus*: South Africa



*Leirus*: northern Africa, Middle East, western Asia  
*Buthus occithanus* (Mediterranean scorpion):  
northern Africa, southern Europe, Middle East.





# The most toxic scorpions of the New World (Buthidae)

*Centruroides* (South of USA, Central America), *Tityus* (Latin America)



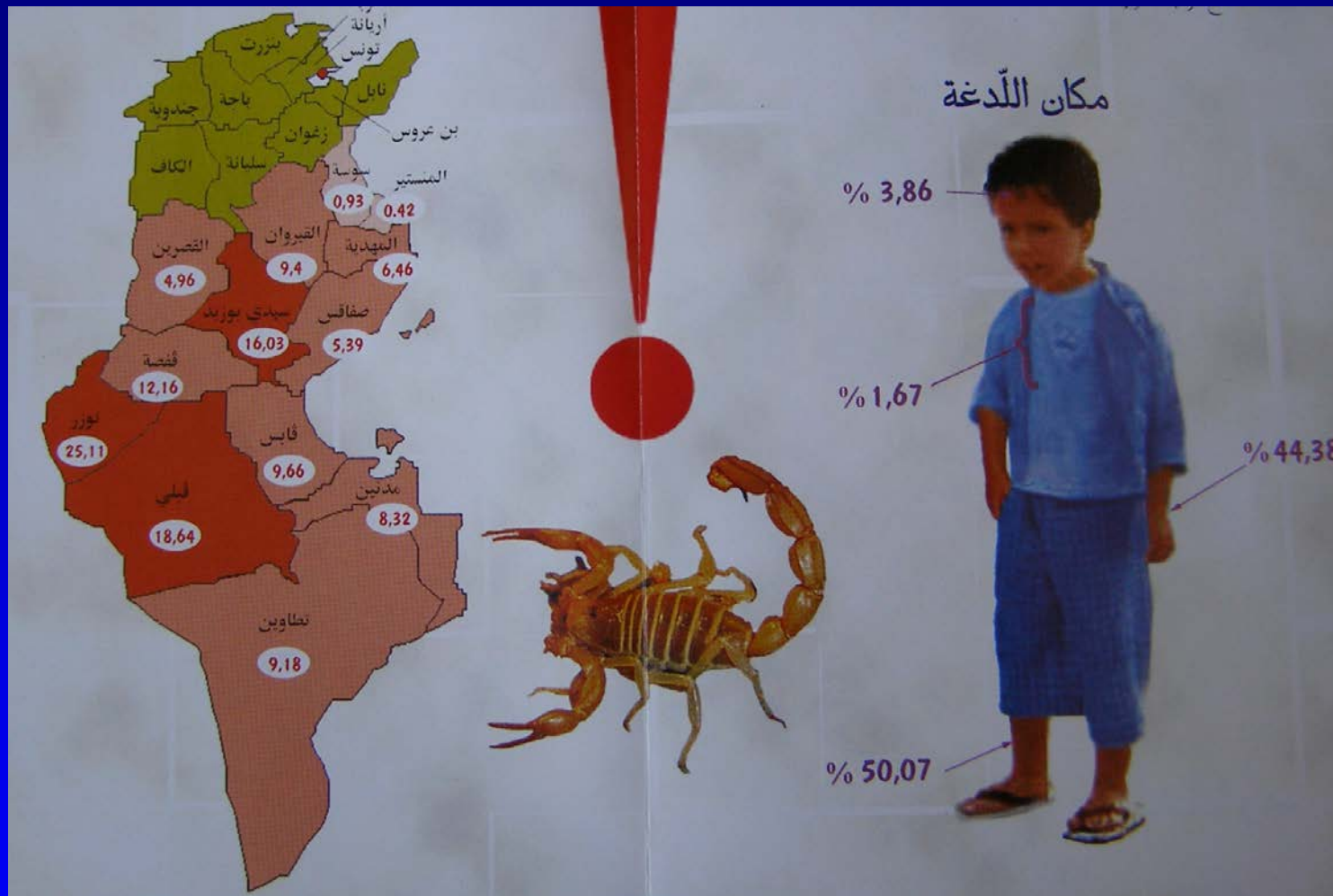
Photo by  
Jillian H. Cowles



© W. Wüster



# Tunisia: various populations/species of genus *Androctonus* differ in toxicity



Mortality rate (%), affected also by accessibility of a medical care.

Localization of bite in %, Prognosis worse in head and body.

# Scorpions in Central and Eastern Europe

*Euscorprius*: ~ 6-20 species in Europe

*E. italicus* around Mediterranean see

*E. tergestinus*: accidentally imported to Czech rep., 1959-1983, now extinct

*E. carpathicus* in Romania.

Nonaggressive, pain like from wasp bite, often in capture.





# Other „less dangerous“ Chelicerata = nontoxic ones

**Uropygi** (*bičovci*),  
*Mastigoproctus giganteus*  
USA, Mexico  
(vinegaroon)



**Amblypigi** (*krabovci*)



## Solifugida

Old World, arid habitats  
nocturnal, insectivorous  
Pedipalps leglike,  
chemoreceptors  
(racquet organs).





Hymenoptera: honey bees, wasps, hornets  
many people allergic and may die (in Europe more  
than 200 per year) due to anaphylactic shock.  
The only deadly toxic animal in Czech rep: viper  
*Vipera berus*, in Europe the worst *Vipera ammodytes*,  
in Cyprus and Turkey *Macrovipera lebetina*.



Linka 155

Toxikologické  
informační středisko  
tel. 224 919 293  
(non-stop).

Klinika anesteziologie,  
resuscitace a intenzivní  
medicíny 1.LF UK a  
VFN Praha  
U Nemocnice 2  
tel. 224 962 243



*Vipera berus* female



*Vipera berus* male



*Natrix tessellata*



*Coronella austriaca*

# Classification of mites (Acari, subclass)

A. Parasitiformes: 1: **Ixodida** (ticks = *klíšťata*) = Metastigmata



Ixodidae (hard ticks = *klíšťata*),

Argasidae (soft ticks = *klíšťáci*)

Nuttalliellidae (one species, unimportant)

2: **Gamasida** (*čmelíkovci*) = Mesostigmata

Dermanyssidae (*čmelíci*)

(and some less important orders)

B. Acariformes:



3. **Actinedida** (*sametkovci*) = Prostigmata = Trombidiformes

Tarsonemidae (*roztočící*), Demodecidae (*trudníci*),

Trombiidae (sametky), and others, like Hydracarina (*vodule*)

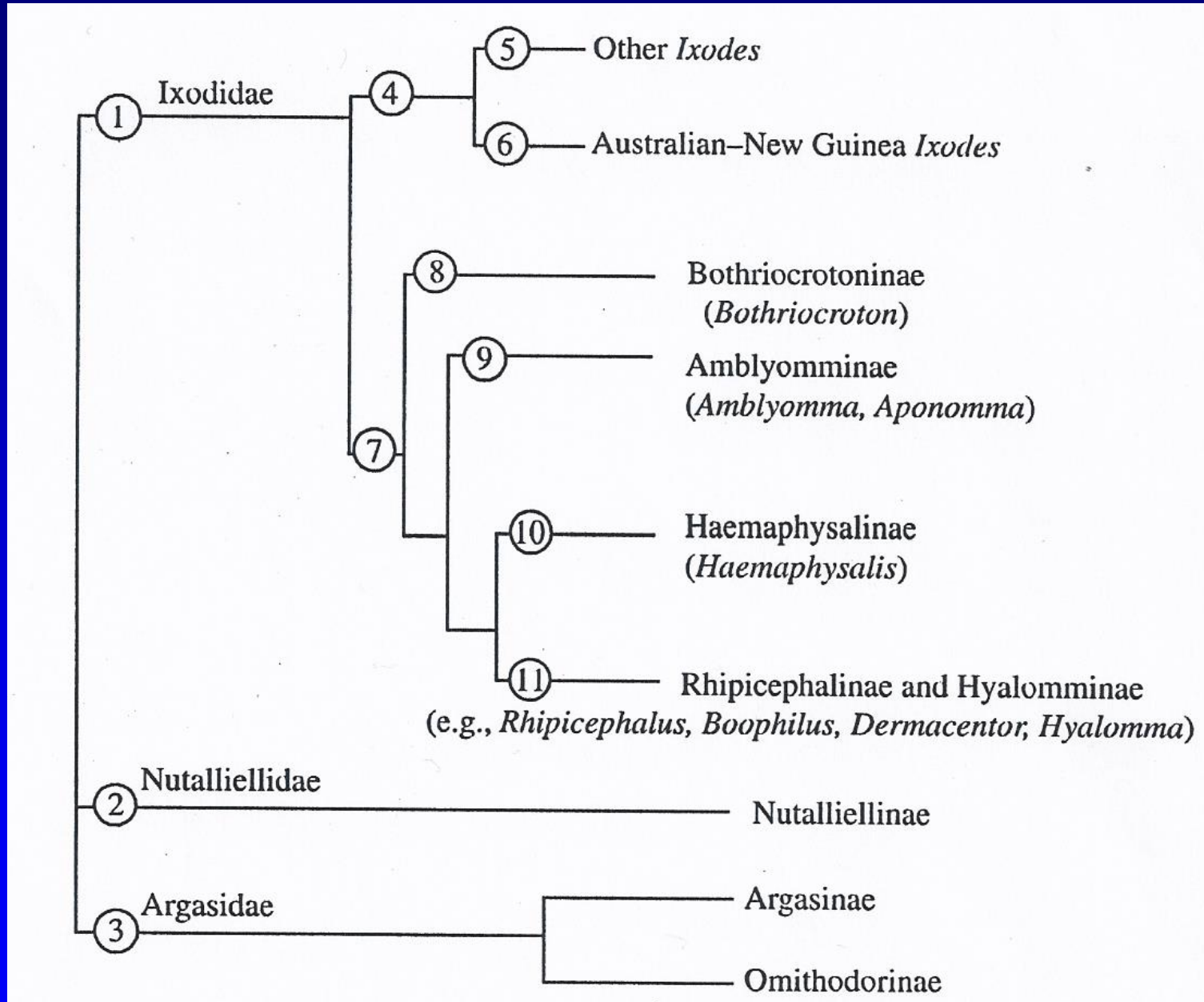
4. **Astigmata** = Sarcoptiformes (*zákožkovci*)

Oribatida (*pancířníci*)

Acaridida: Acarididae (*sladokazi*),

Sarcoptididae (*zákožky*)

# Ixodida: phylogenetic tree of families and subfamilies





## Argasidae (soft ticks)

Morphological differences .

2-7 nymphal stages

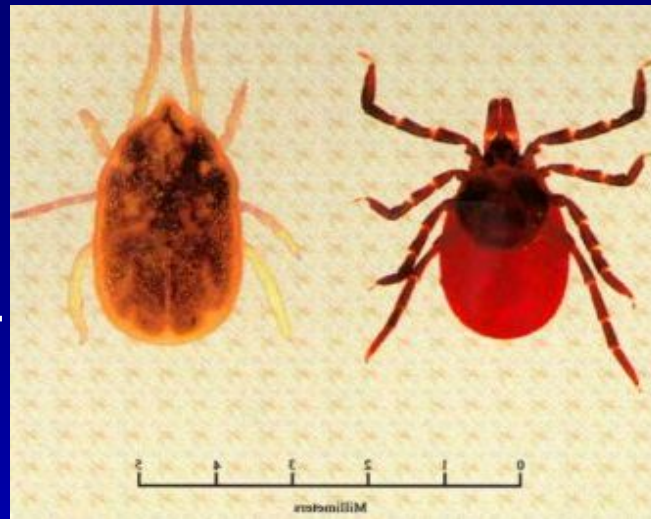
Actively search for the host

Feed on host quickly (minutes),  
repeatedly during the life  
Hide in resting places.

Excess of water to coxal glands

Mate in resting places, several times,  
unfed

Hundreds of eggs several times



## Ixodidae (hard ticks)

.. Shown in practical courses

a single nymphal stage

Usually wait on the vegetation

Feed slowly, for several days.  
adults feed only once (males even 0)  
take a big volume of blood (ml)  
multiply their weight many times

Excess of water to saliva

Meet and mate on the host, once in life,  
partially fed

Thousands of eggs once in life

## Tick life cycles: differences in instar numbers, host numbers, feeding preferences and host specificity

1. Repeated feeding on the same or different hosts:  
Argasidae, some Ixodidae
2. Three host life cycle: (90% of Ixodidae).  
The cycle takes 1-3 years (temperate vs. tropical areas)
3. Two host life cycle: adaptation for big mammals migrating in savannah.  
*Hyalomma*, Larvae moult on the host.
4. Single host life cycle: typical for *Boophilus* (*Rhipicephalus*) on cattle.  
In tropics, several generations per year.

### Host specificity:

Strictly specific, like *Aponomma* on reptiles, typical for some hosts: bats (hosts more than 50 specific species of *Argas*, *Ornithodoros* and *Ixodes*),  
Non-specific for the host = opportunistic, like *Ixodes ricinus*  
Many important vectors of zoonoses.



# Argasidae

## 1. *Argas*:

Arid areas, typically parasites of birds.

Larvae stay on host few days, other instars less than hour. Allergic reactions, skin hypersensitivity, anemia.

*Argas reflexus*: Czech, pigeons, cities like Prague

*Argas vulgaris*: Ukraine, *Argas polonicus*: Morava

*Argas persicus*: chicken, today cosmopolitan, Slovakia, Balkan countries.

Veterinary importance: Economic losses in chicken, *Borrelia anserina*, bird viroses.



## 2. *Otobius*:

Few species, mainly on cattle.

*Otobius megnini*: spinose ear tick, nymphs with spines, one host soft tick. Larvae into the ear, feed for days, then nymphs for up to several months. Damage to the ear and the eardrum.

Adults non-parasitic. Typical for North America, today elsewhere in tropics and subtropics (Africa, India).



### Argasidae: 3. Ornithodoros

Many species. In nests, rodent burrows etc.  
Assembly pheromone guanine. Resistance to starvation.

Transmission of many *Borrelia* species, high pathogen-vector specificity.

Causative agents of endemic recurrent fevers.

Antigenic variability, antigens coded on linear plasmids.  
Transovarial and transstadial passage, transmission by bite and from coxal glands (behind 1st coxae).

Old World:

*O. moubata* (complex of species, Africa, domestic animals, humans, *Borrelia duttoni*), larvae do not feed, nymphs parasitic, variable number of nymphal stages (4-5).

*O. erraticus* (Mediterranean, African swine fever, DNA virus, transovarial transmission in ticks (plus contact of pigs and contaminated food, mortality up to 100%))

*O. savignyi*, *lahorensis* etc: Africa, Asia, including touristic destinations.

*O. tholozani* and others (Asia, colonial birds, bird borrelioses).

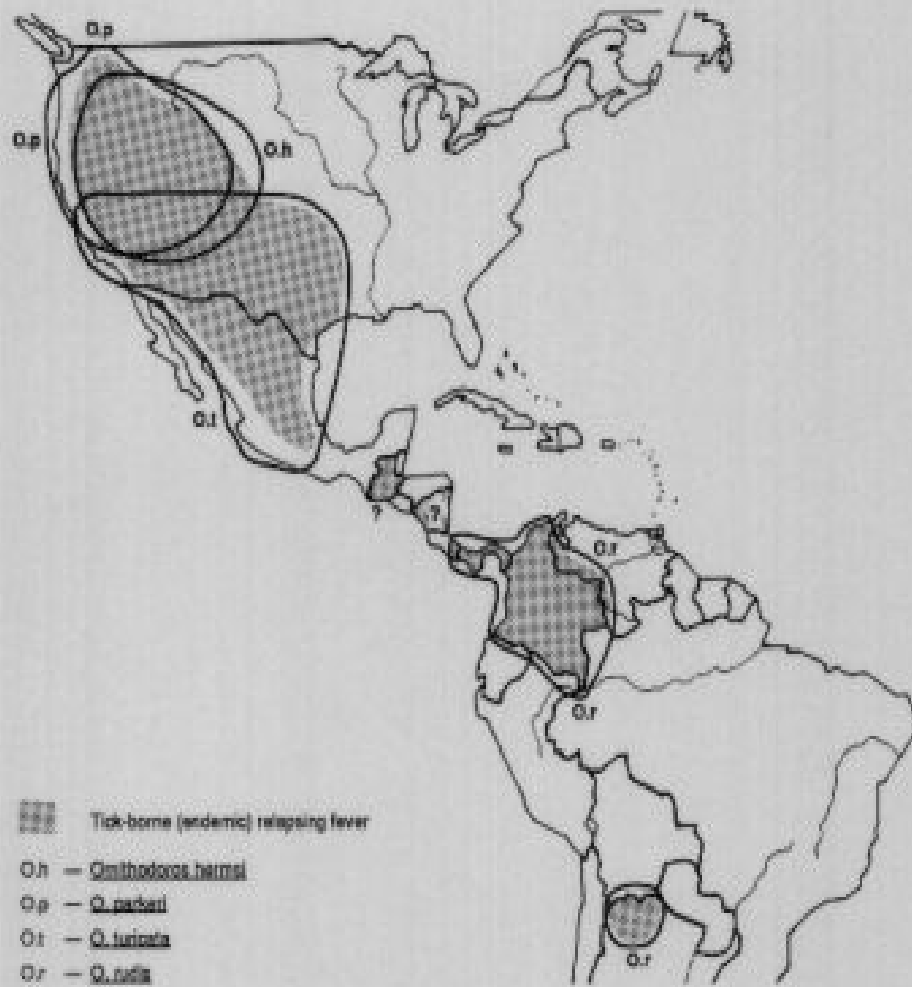
New World: *O. hermsi*, *parkeri*, *turicatae*: Rocky Mountains, South and West of USA  
*Borrelia* (*hermsi*, *parkeri*, *turicatae*), rodent reservoirs, humans occasionally infected



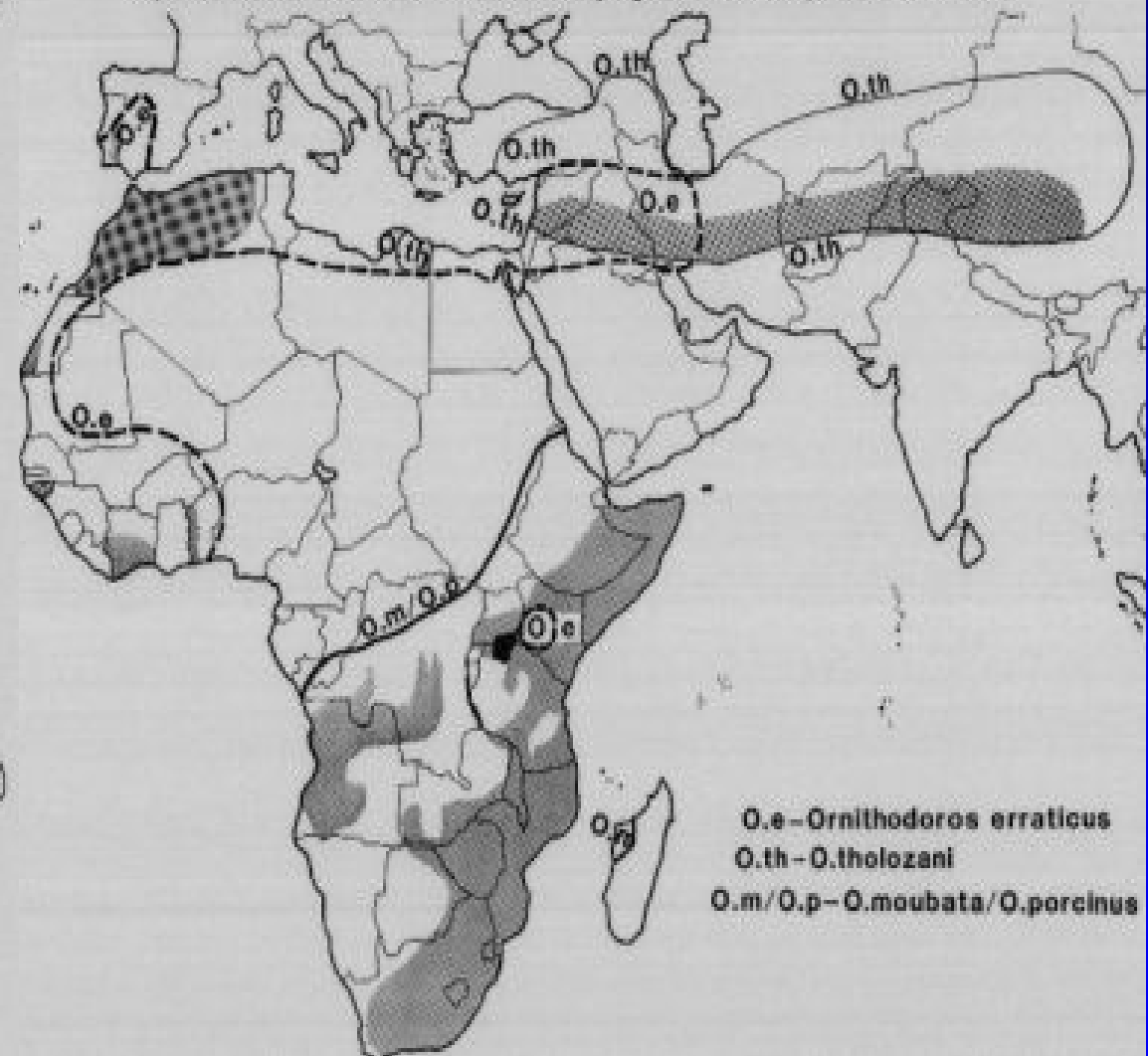


# Distribution of *Ornithodoros* ticks and borrelioses they transmit

Map 24 New World Distribution of Endemic Tick-borne Relapsing Fever and the Principal *Ornithodoros* Vectors



Map 25 Old World Distribution of Endemic Tick-borne Relapsing Fever and the Principal *Ornithodoros* Vectors



# *Ixodes*

*Ixodes ricinus* (*klíšťě obecné*)

castor been tick (castor been = *Ricinus c.*)

Leaf or mixed forest, bushes, ecotones

Most of Europe, from Ireland to Ural

Three host tick, cycle 2-4 years.

Questing tick.

Various life stages prefer various types of hosts.

*I. persulcatus* (taiga tick): from Baltic see to Japan

In USA deer ticks *I. dammini* (East), *I. pacificus* (West):  
rodents (*Peromyscus*), deer (*Odocoileus*): Lyme disease

Host specific ticks in nests of rodents or birds:

*I. trianguliceps*, *I. hexagonus*, *I. lividus*, *I. uriae*

*Ixodes holocyclus* (Australian paralysis tick):

Paralysis of domestic animals, antitoxin available.

Toxins produced by more than 40 tick species (*Argas*,  
*Dermacentor andersoni* ap.), limb weakness in the hind  
legs, neurotoxins.

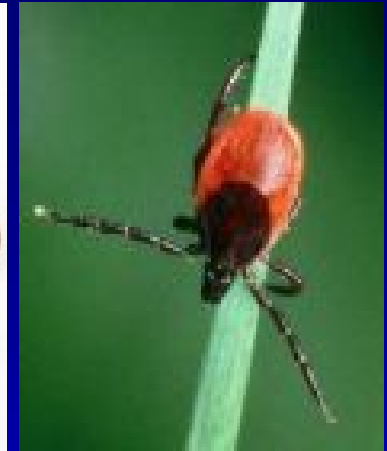


Figure 2. *Ixodes scapularis* mating. Photo courtesy of the Lyme Disease Association's photographer, Jim Occl.





## Ixodidae: important genera

**Haemaphysalis:** Old World (Palearctic region)

*H. concinna* (*klíšť lužní*): Morava, tularemia

**Dermacentor:** Old+New world (Holarctic region)

*D. reticulatus*: (*piják lužní*), Morava, sporadically Bohemia  
edge of pastures, dog babesiosis.

*D. marginatus*: (*piják stepní*) Slovakia, Morava?

*D. andersoni* (Rocky mountain wood tick)

*D. variabilis* (American dog tick) USA, including East coast.  
colofull scutum, questing ticks

**Hyalomma:** Old World, the largest ticks.

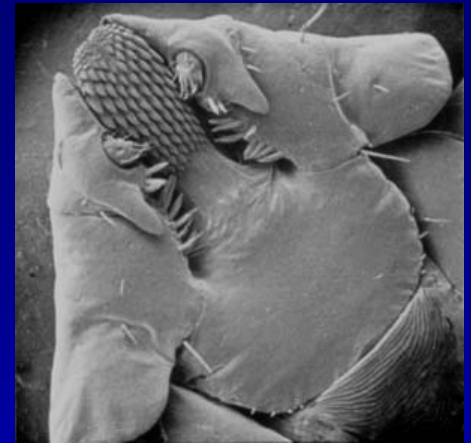
Arid regions, steppen biotopes, walking on ground

*H. marginatum*: Mediterranean, Russia, Turkey etc.

nymphs on birds, adults on large mammals, horses.

spreading in Europe (Germany, Austria, sporadically in CZ)

*H. aegyptium*: Balkan countries, on *Testudo* turtles



## Ixodidae: important genera

**Amblyomma:** most species in tropics and subtropics, mainly cattle Africa: *A. variegatum* a *A. hebraeum*: America: *A. americanum* (Lone Star tick), etc.  
AGS: allergy to alpha-Gal, tick bite allergy, red meat allergy  
alpha-Gal in mammals but not humans, symptoms 2-6 hrs post eating „red“ meat: rash, vomiting, drop of blood pressure, stomach pain  
Salivary oligosaccharides with alpha-Gal.

### **Rhipicephalus:**

a) Three-host ticks (ancient type of life cycle)

*R. sanguineus*: Mediterranean, dogs, imported to Czech rep.

*Rhipicephalus appendiculatus*: cattle in Africa

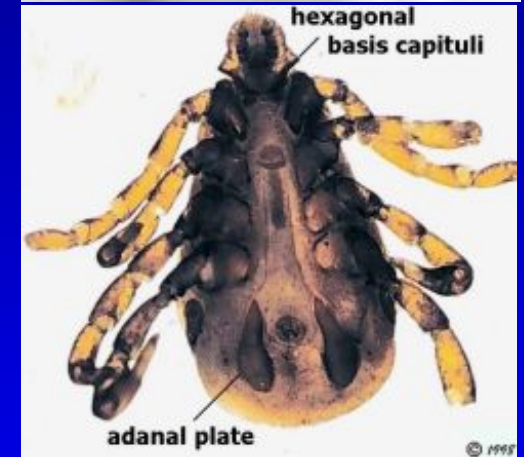
b) One-host ticks (subgenus **Boophilus**).

Typically cattle, NOT on humans

*B. microplus* (Australia, Latin America, eradicated from USA, quarantine, new findings in Texas, alternative host *Odocoileus* (white tailed deer)

*B. decoloratus* (Africa)

Both transmitting cattle diseases, mainly babesioses.





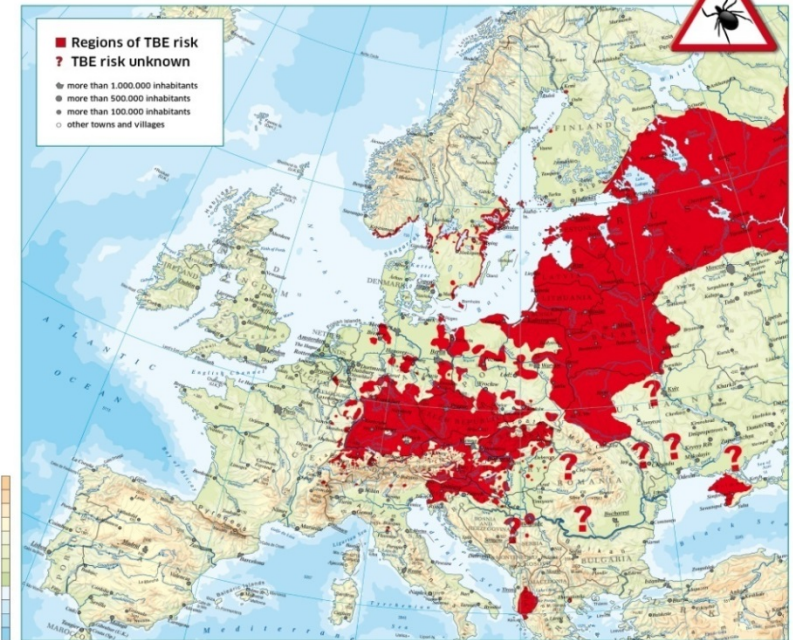
# Viruses transmitted by ticks: Flaviviridae

## European Tick-Borne Encephalitis (TBE)

mainly *I. ricinus*, hundreds cases every year in Czech republic, 2021: 854 reported cases. infection rate of ticks up to 5% (in foci) transovarial transmission, co-feeding, milk contamination (mainly goats: Rožňava), goat and sheep cheese (Košice 2016). Two phases of disease: 1. fever, 2. (in 30%) after 1-3 weeks neurological symptoms, then in cca 10% chronic problems, 1% mortality. Two similar vaccines available.

TBE\*/FSME in Europe 2011

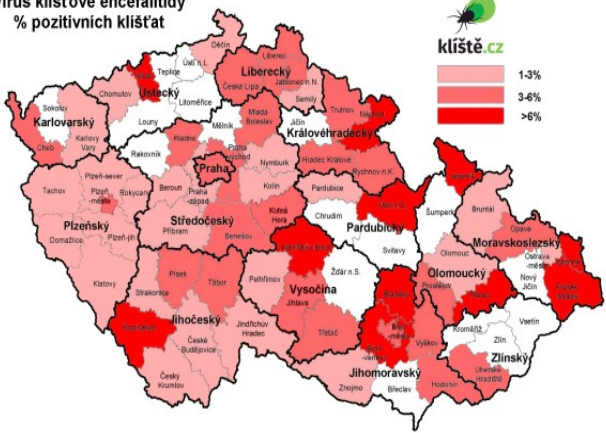
\*Tick-Borne Encephalitis/Frühommer-Meningoencephalitis



The extent of epidemiological assessment of TBE cases varies between countries. The data presented here may therefore not be entirely complete, and it cannot be excluded that TBE viral infection - with subsequent development of the disease - will occur in new areas. This map is based on documented cases of TBE virus infection as reported by WHO and national health institutions. Last updated: December 2011. Baxter AG, Industriestrasse 97, 1221 Vienna, Austria.

BS-V4-036 December 2011

Virus klíšťové encefalitidy  
% pozitivních klíšťat

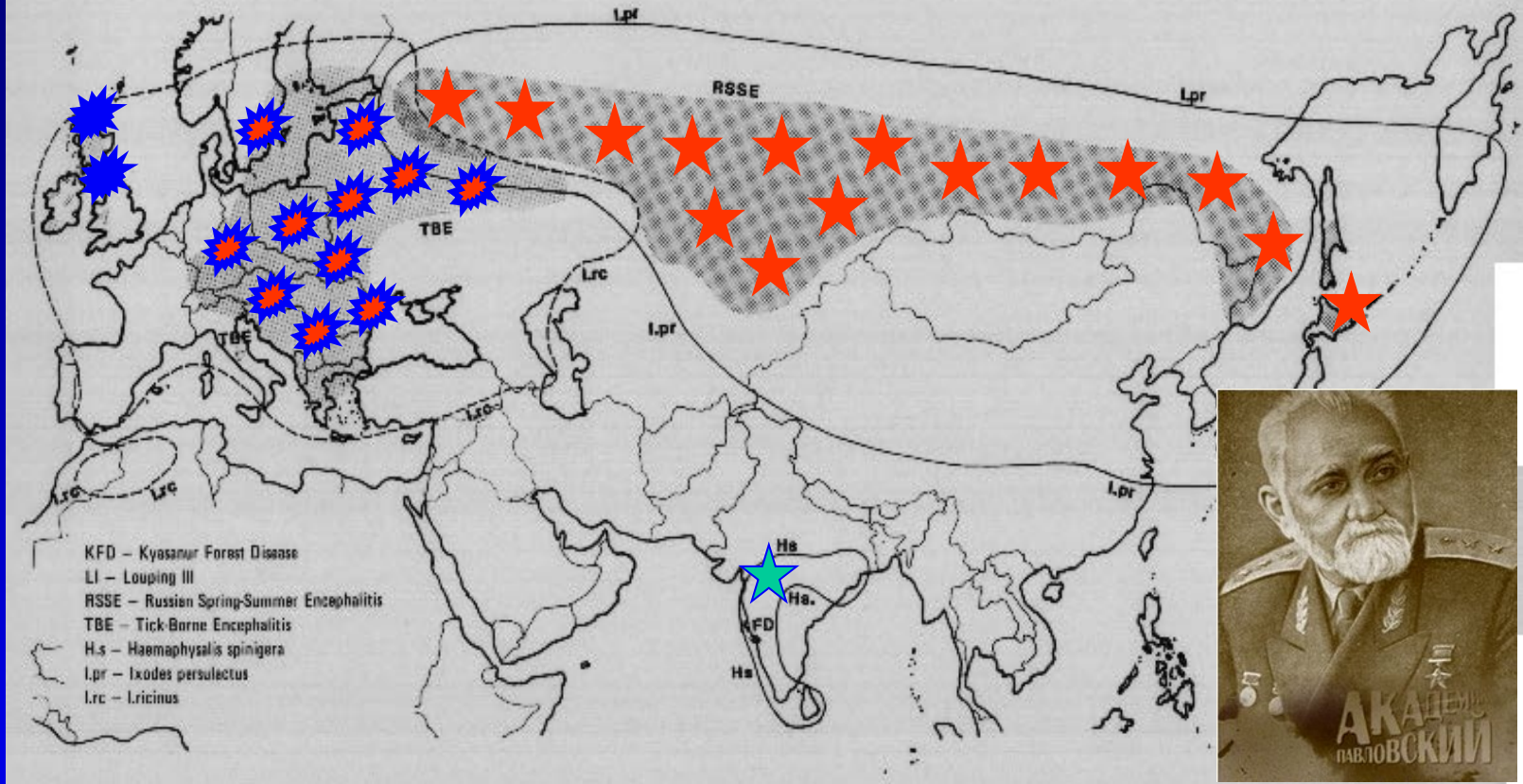


## ZÁKLADNÍ OČKOVACÍ SCHÉMA – PRO CHLADNÉ MĚSÍCE



## Distribution of flaviviruses from TBE group

Louping ill:  
mainly *I. ricinus*,  
sheep, UK.



### Russian Spring-Summer Encephalitis

Siberia: *Ixodes persulcatus*, J.N. Pavlovskij, theory of natural foci

**Kyasanur forest disease:** India, haemorrhagic fever, hundreds of human cases every year, *Haemaphysalis* and mammals, human-made changes of environment



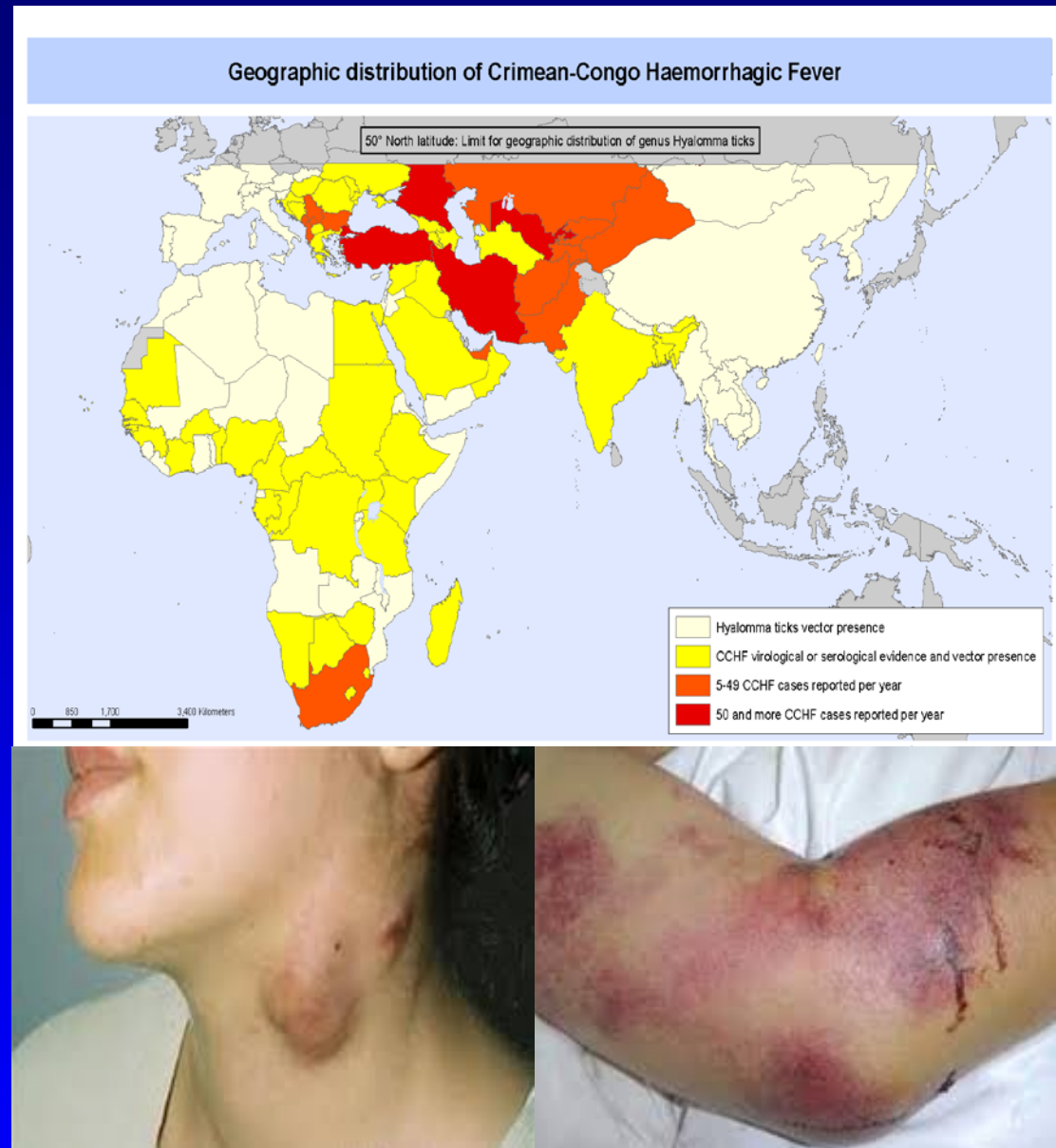
# Viry přenášené klíšťaty: Bunyaviridae

Congo-Crymean haemorrhagic fever, (CCHF), Crymea 1944,  
*Nairovirus*, 30% mortality !!!  
Wide distribution !!!

Two phases: 1. „flu-like“,  
2. Neurologic complications, bleeding  
to mucosa, intravascular coagulations,  
hepatomegaly, kidney failure.  
Asia, Africa, Turkey, Balkan

*Hyalomma marginatum*, transovarially,  
reservoir: various mammals,  
transmission also by contact or blood  
transfusion.

*H.marginatum* spread in Europe.  
Sporadic cases of CCHF in Bulgaria,  
and Balkan, but also in Spain.



# Tick-borne bacteria: *Borrelia*

*Borrelia burgdorferi*, *B. afzeli*, *B. garinii*:

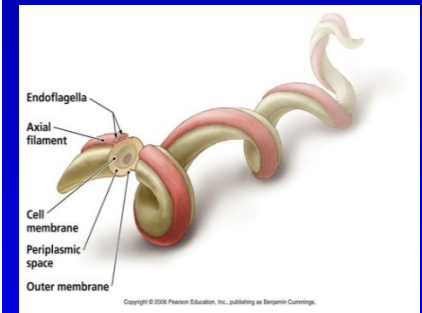
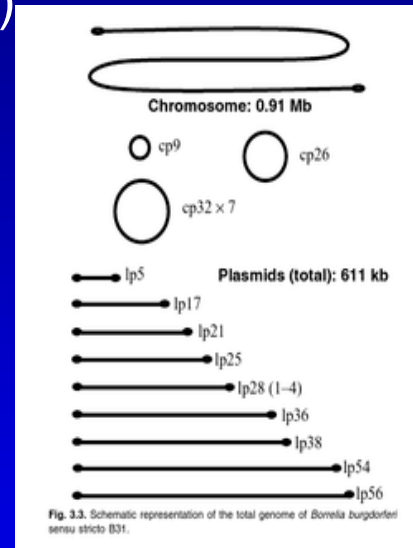
transstadially, not transovarially.

Regurgitation or from gut first to salivary glands.

*I. ricinus* bite (plus contamination of conjunctiva etc)

Czech rep: 4 - 5 000 reported cases every year.

1. Erythema chronicum migrans (ECM),
  2. Reumatoid-like complications, skin and heart problems, neurological symptoms, autoimmune disease. Crossreacting Ags
- Antigenic changes OspA (midgut) x Osp C in vertebrate. Genes localized on plasmids.





# Borrelia burgdorferi sensu lato

Europe: various genospecies (over 10) different hosts, *Apodemus* mouse, birds (*B. garinii*), lizards (*B. lusitaniae*)  
 Infection rate of *I. ricinus*: up to 50% (much lower in other tick species).

USA: *Ixodes dammini* and *I. pacificus*: 1 main genospecies, *Peromyscus*

**Treatment:** doxycylin, penicilin, cefalosporins

## Vaccine:

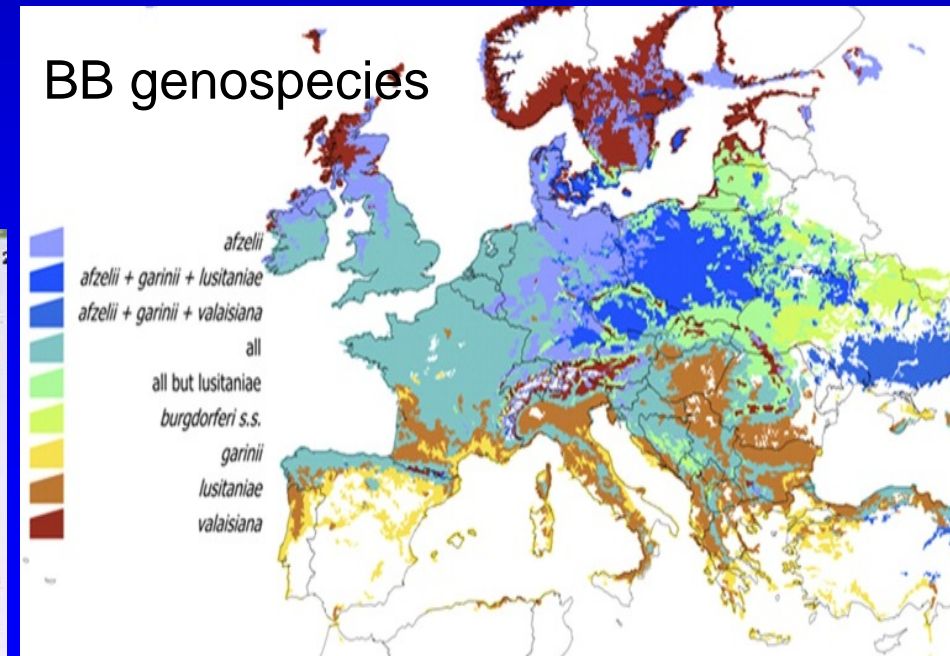
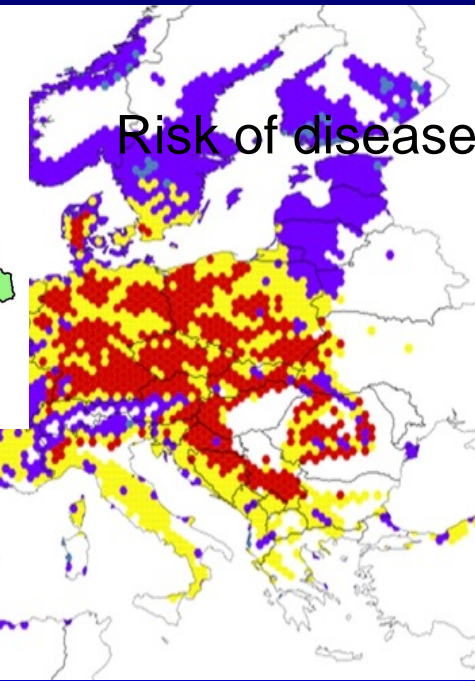
USA: Lymerix 1998-2002.

Based on OspA, 78% protection but arthritis in genetically predisposed people.

CDC 2022: Not currently available

Europe: commercially available canine vaccines (low protection?)

Development of the new human „multiepitope“ vaccine.



## Tick-borne bacteria: *Rickettsia*

### *Rickettsia conorii*

Europe: *Rhipicephalus sanguineus*  
(Marseilles fever, Boutonneuse f.)

Transovarially transmitted

Dogs are asymptomatic reservoirs,  
Infected by bite or orally.

And other rickettsioses of the Old World:  
mainly in Africa (*Amblyomma* etc).

### *Rickettsia rickettsi*

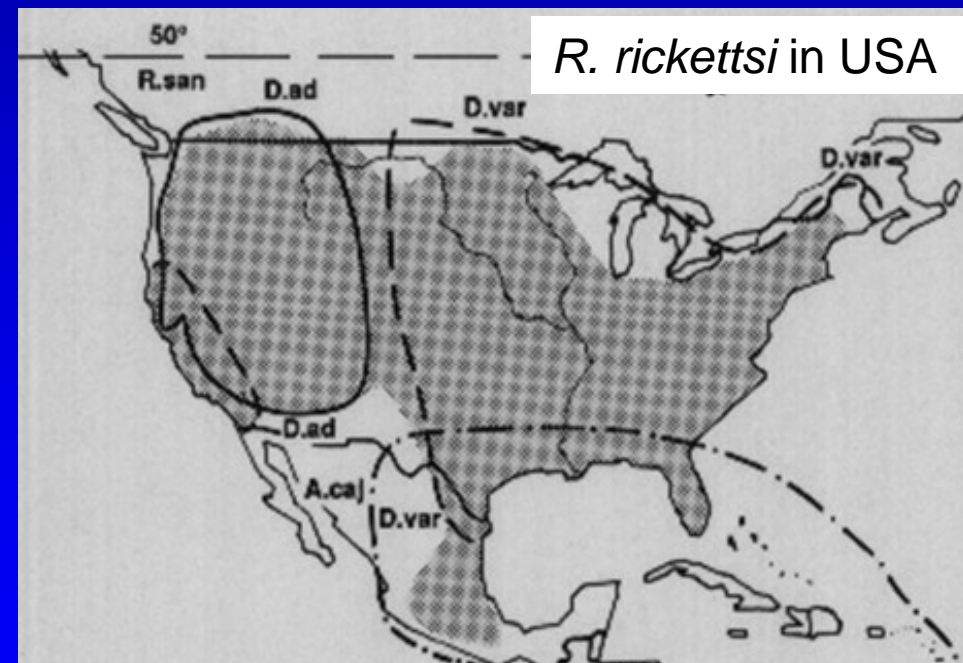
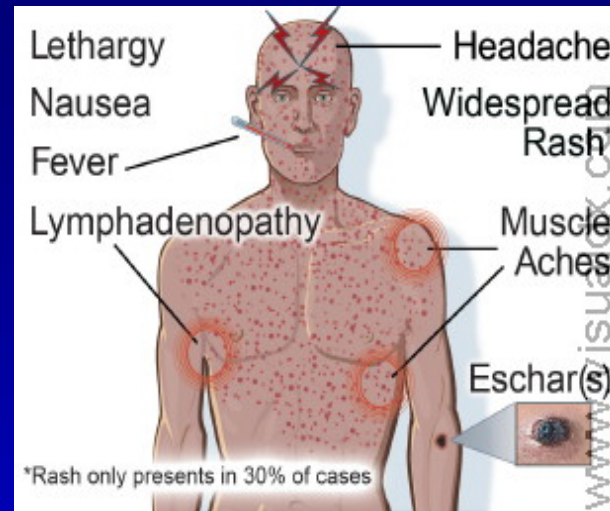
Rocky mountains spotted fever

Transovarially transmitted

USA: *Dermacentor andersoni*, *D. variabilis*

Various epidemiology (East suburban,  
West in Rocky mountains,  
native tribes versus pioneers)

Columbia, Mexico etc. (*Amblyomma*, *Rhipicephalus sanguineus* (positivity up to 15%))





## Tick-borne bacteria: Ehrlichia

Intracellular bacteria, close to rickettsia. PCR diagnostics.  
Five genera, most important *Anaplasma*, *Ehrlichia*, *Cowdria*

*Anaplasma*: various strains and genospecies often in ticks

*A. phagocytophilum* (= *E. phagocytophila*): in Europe *Ixodes*

In neutrophils, granulomatous ehrlichiosis in dogs, cats, horses  
and humans. Dogs and cats often asymptomatic reservoirs.

Chronic autoimmune disease, destruction of bone marrow and platelets.

USA, Mediterranean area, Middle and Northern Europe, Scandinavia. *I. ricinus*

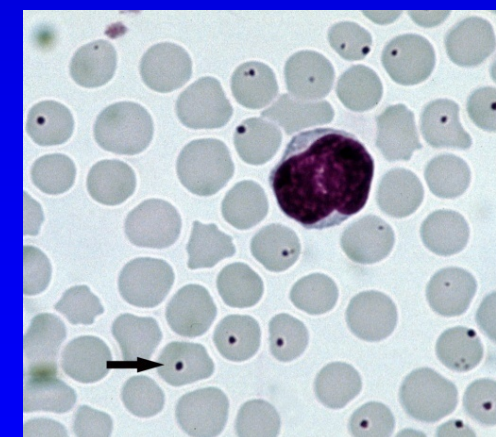
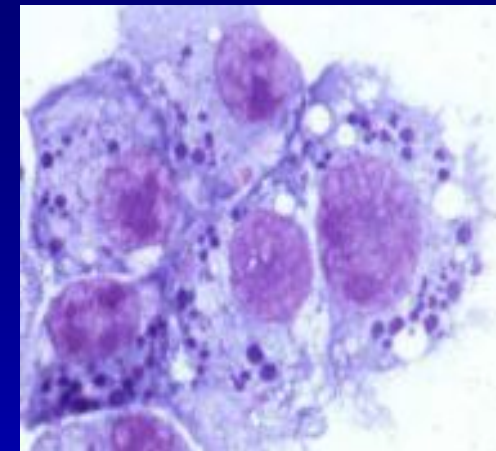
Migration of pets, molecular diagnostics (PCR)

Vaccine does not exist, chemotherapy by antibiotics (doxycycline and other tetracyclines)

*A. marginale*: *Boophilus*, inside erythrocytes, the most frequent cattle pathogen in  
Africa and America, affects liver and spleen, causes anemia

*Ehrlichia canis* (pancytopenia in dogs, „canine AIDS“):  
mostly Mediterranean, *R. sanguineus*

*Ehrlichia (Cowdria) ruminantium* (heart water fever):  
east and South Africa, wild ruminants asymptomatic,  
Cattle: endothelial cells, central nervous system, tissue lesions



## Tick-borne protozoa: *Babesia* and *Theileria*

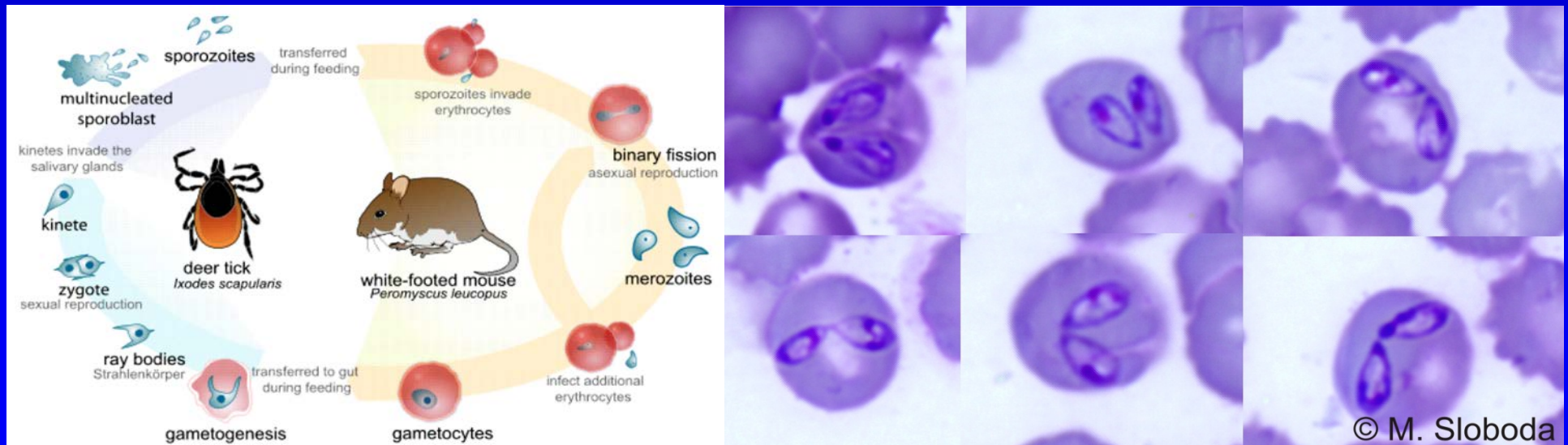
*Theileria parva*: cattle, East Coast Fever, NOT transovarially, only transtadially  
*Rhipicephalus appendiculatus*

*Babesia divergens* (evropská babesiosa): cattle and splenectomized humans,  
transovarially and transtadially

*Babesia microti*: American rodent babesiosis (North-East of USA),  
Immunocompetent humans, hemolytic anemia, hemoglobinuria,  
autoimmunity against erythrocytes, malaria-like symptoms,  
chemotherapy (imidocarb, pentamidine)

*Babesia canis*: dogs, usually asymptomatic, *Rhipicephalus sanguineus*,  
recently also in Slovakia and Moravia, *Dermacentor reticulatus*

*Babesia bigemina*, *B. bovis*: cattle, Texas fever, Theobald Smith (1893) *Boophilus*.



# Tick control

In Czech rep. seasonal dynamics  
Mainly from April till August, second peak  
in some years (Sept.).

Depends much on biotope and weather.

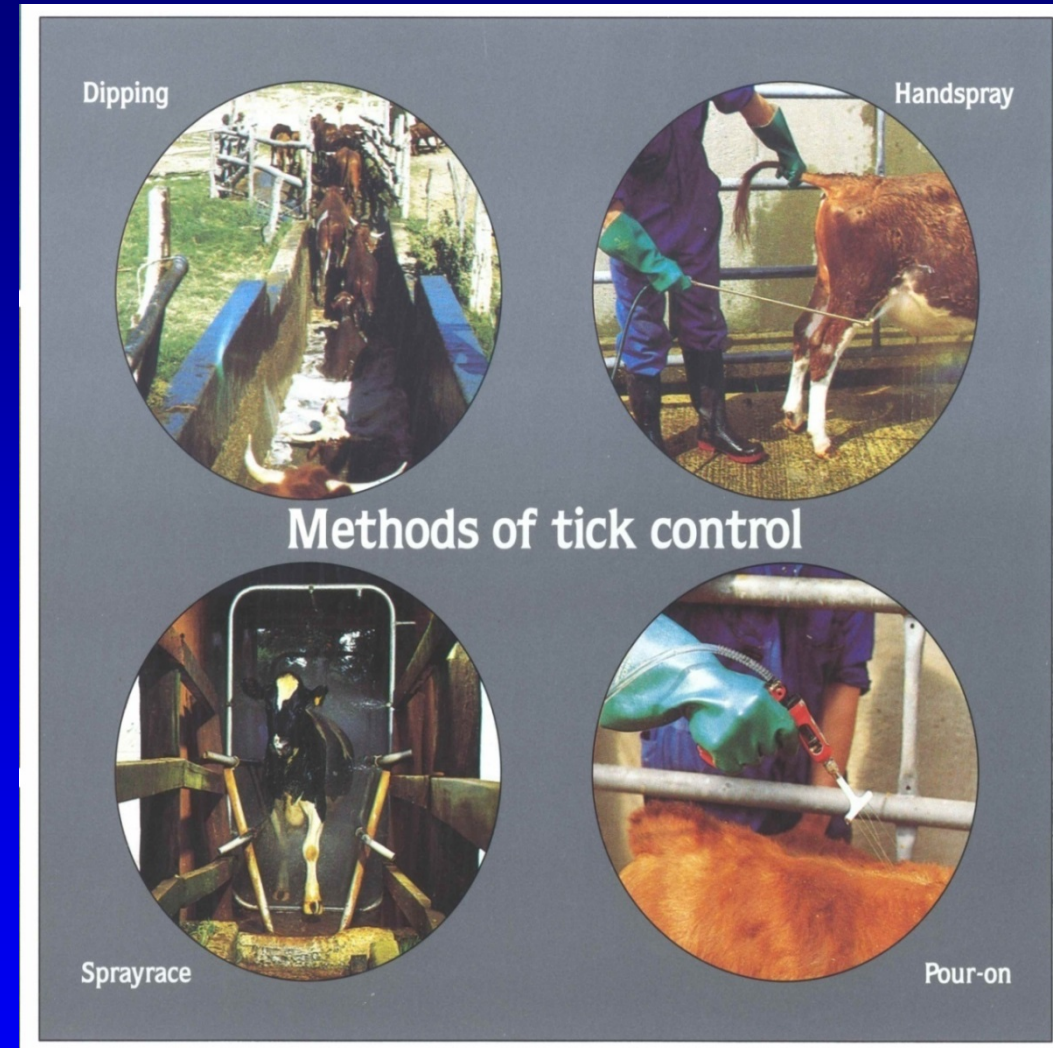
Collection methods: flagging, CO2 traps

Personal protection:

Proper clothing, repellents, insecticides.  
Do not sit or lay in vegetation, Personal  
search for attacking ticks ASAP.

Group protection: cutting grass,  
insecticides questionable.

Protection of cattle: spraying, dipping,  
Africa, America etc





# Classification of mites (Acari, subclass)

A. Parasitiformes: 1: **Ixodida** (ticks = *klíšťata*) = Metastigmata



Ixodidae (hard ticks = *klíšťata*),

Argasidae (soft ticks = *klíšťáci*)

Nuttalliellidae (one species, unimportant)

2: **Gamasida** (*čmelíkovci*) = Mesostigmata

Dermanyssidae (*čmelíci*)

(and some less important orders)

B. Acariformes:



3. **Actinedida** (*sametkovci*) = Prostigmata = Trombidiformes

Tarsonemidae (*roztočící*), Demodecidae (*trudníci*),

Trombiidae (*sametky*), and others, like Hydracarina (*vodule*)

4. **Astigmata** = Sarcoptiformes (*zákožkovci*)

Oribatida (*pancířníci*)

Acaridida: Acarididae (*sladokazi*),

Sarcoptididae (*zákožky*)

Most mites ectoparasitic, small number of endoparasites in lungs of mammals birds and reptiles, some free living cause skin and respiratory allergies.

# Gamasida (Mesostigmata)

larva and two nymphal stages, proto and deutonymph  
Three parasitic families differ in shape of chelicerae:  
Dermanyssidae, Macronyssidae, Laelaptidae



**Dermanyssidae** (*čmelíkovití*, nebo *čmelíci*)  
Whip-like and long chelicerae, hematophagous

***Dermanyssus gallinae*** (red poultry mite, *čmelík kuří*), *D. hirundinis*, *passerinus*  
Avian parasites, anemia, mortality in nestlings. Rash in humans.  
Unfed grey, 0,75 mm, bloodfed dark red. Fast cycle (7-10 days).  
Females live for several months, parasitic adults and nymphs.  
Various microorganisms detected, no evidence for transmission.  
Control: find and destroy the source (resting places, bird nests).  
In farms: authorized acaricides (phoxim, fluralaner, spinosad),  
resistance led to use of unauthorized acaricides (fipronil residues in eggs).



***Liponyssoides sanguineus***: Subtropics and tropics all around the World.  
Mainly on mice, often on homeless humans: rodent mite dermatitis.

***Rickettsia acari*** (*neštovice*): USA (1946), Ukraine, Korea, Africa. Transovarially.

## Macronyssidae

chelicerae with small „pincers“  
without teeth, hematophagous

***Ornithonyssus*** (*čmelíkovec*):  
Most species on birds but...



***Ornithonyssus baccoti*** (*čmelík krysí*):  
(tropical rat mite)

rats, globally, temperate areas.

life cycle 7-14 days, frequently attack humans.

Painful bites (skin hypersensitivity), repeatedly.

Antihistaminics (oral or topical), repellents (DEET).

Pest in colonies of laboratory rodents.

Laboratory transmission of various microorganisms, but NOT in nature.



***Ophionyssus***: reptile mite, common in snakes, in capture on various reptiles.  
Ivermectin to reptiles, freezing or heating of aquarium, biological control.



## Laelaptidae (*savenky*)

Strong chelicerae „pincers with teeth“, commensals, parasites.  
*Laelaps*: on rodents (name from greek mythology).  
Other mites on insects (dung and carabid beetles or honey bees).



*Varroa destructor* (*kleštík včelí*): on *Apis mellifera* (*v. medonosná*)

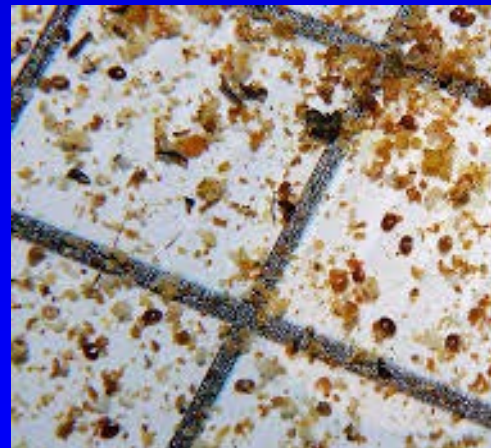
*V. jacobsoni* closely related species on *A. cerana* (*v. východní*)

Varroosis, imported from Russia and China.

Life cycle fast, one week during bee pupal stage.

Mated females (2 mm) on young bee, espec. drones.

Control: fumigation by insecticides: Varidol (amitraz) etc.  
evaporation of formic acid (formidol). Control of debries  
from a hive (*měl*). Recommended schedules! [www.beedol.cz/varroaza](http://www.beedol.cz/varroaza)



# Actinedida (*sametkovci* = Prostigmata s.lat. = Trombidiformes)

very heterogeneous order

**Trombiculidae** (chiggers = sametky)

Large and colorful adults, „velvet surface“, predators.

Complicated life cycle: three active stages

larva, nymph (deutonymph), adult

Two quiescent stages: protonymph and tritonymph, histolysis, metamorphosis (similar to pupa).

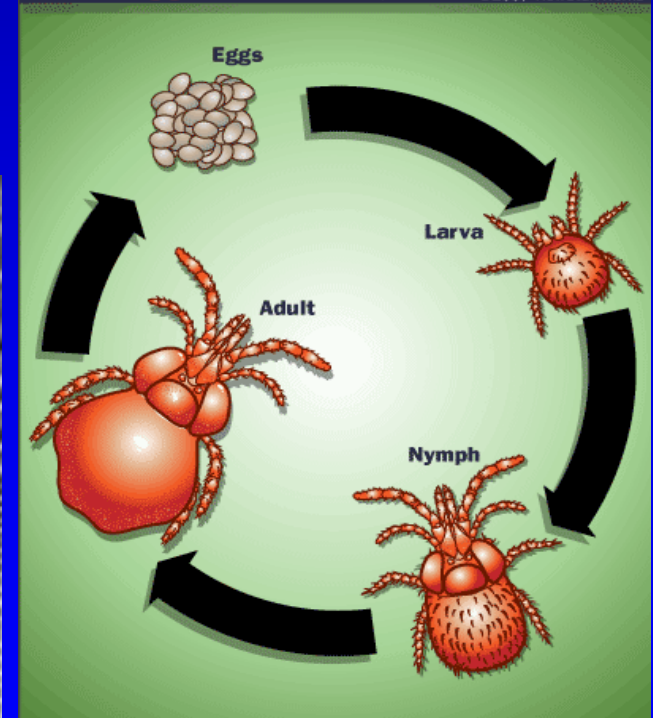
In some species larvae parasitic, mainly on rodents

Two parasitic genera *Neotrombicula* and *Leptotrombidium*.



nonparasitic *Trombidium* (adult)

How Chiggers Work Life Cycle ©2007 HowStuffWorks





***Neotrombicula autumnalis*: (*sametka podzimní*)**

autumn chigger, most abundant species in Europe.

Larvae: 0.2 mm, unfed red, fed pale (fed by lymph)

Mainly at the end of summer (August, September).

Parks, gardens, usually not exposed to direct sunshine.

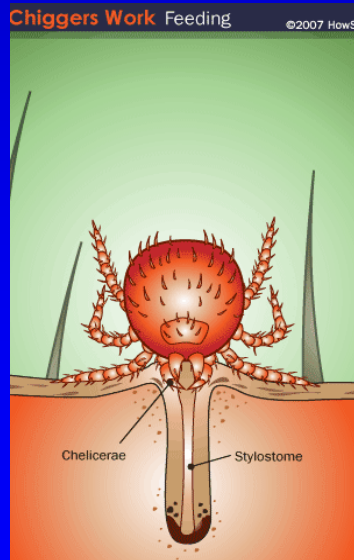
Feeding for 2 days, lytic secrets form „histiosifo“,

but hypersensitive reaction lasts for two weeks.

Localization usually on more humid parts of the body.

Treatment: anti-itch cream with antihistaminics (Fenistil)

Prevention: avoid infested sites, Insecticides?



# *Leptotrombidium*

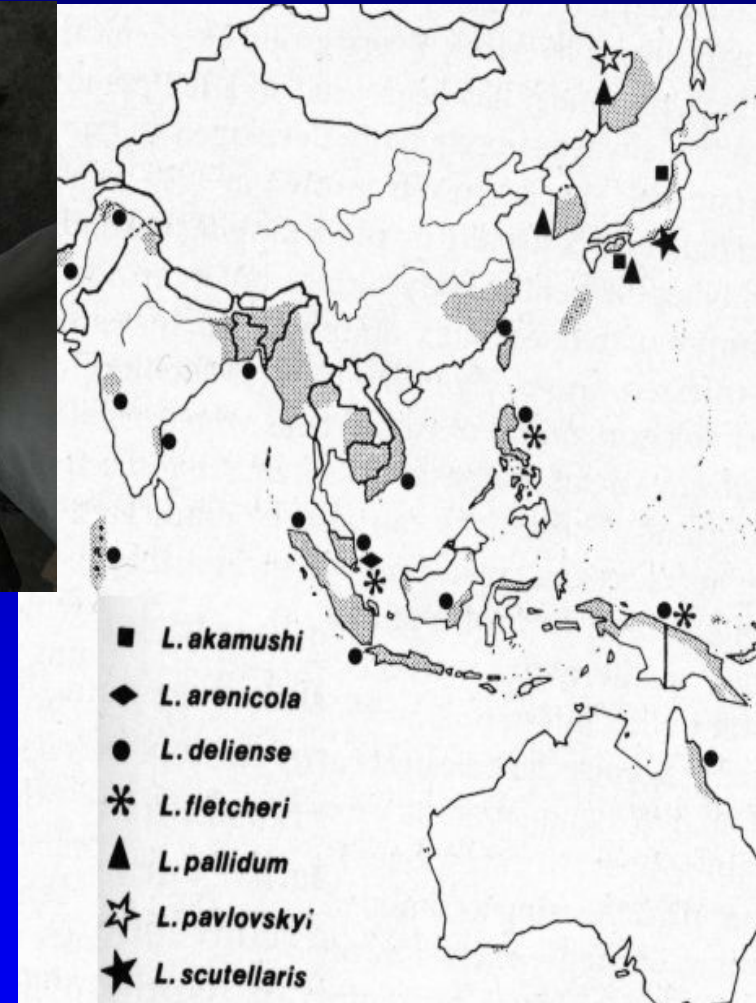
Many species in East Asia

Transmission: rickettsioses

*Orientia tsutsugamushi*

Zoonosis, chiggers as reservoirs

Efficient transovarial transmission



During WW2 in Asia the second most important vector-borne disease (after malaria).

Biotops with secondary vegetation, edges of villages with bushes and many rodents. Classical example of focal disease caused by environmental changes due to human activity.



## Demodecidae (trudníci)

Host specific, commensals.

### *D. folliculorum*

0.3 mm, long body, in hair follicles.

*D. brevis*: shorter, in sebaceous glands.

20-70% of human population,  
prevalence increases with age.

By contact, migrating tritonymphs.

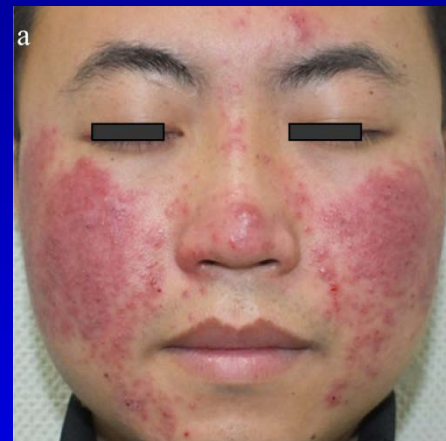
Acne rosacea, often in patients with  
seborrhea (*mazotok*), skin bacteria.

Antibiotics and ivermectin.

### *D. canis*

mites in hair follicles, red mange,  
In some canine breeds dermatitis,  
allergies, immunosuppression.

Acaricides: Ectodex (amitraz)



# Cheyletidae (dravčici)

Often predators, pin-like chelicerae, big palps, biological control (Taurus®) against storage mites and *Ophionyssus*. *Cheyletus*, *Amblyseilus*, in the past commercially available (Biola, Chelčice).



## *Cheiletiella*

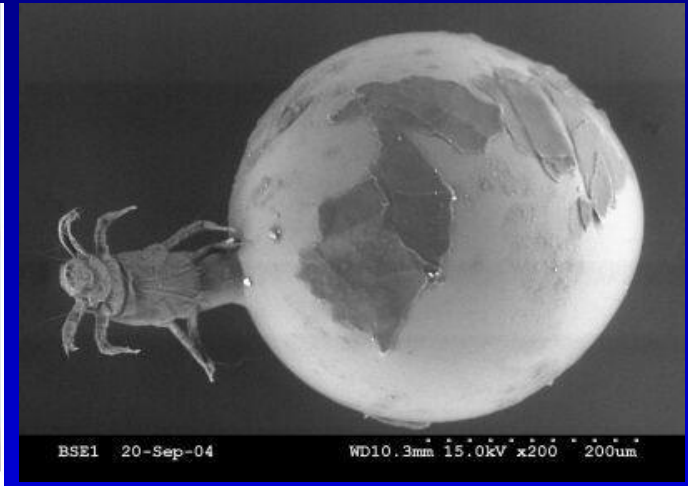
Up to 0.5 mm, eggs on hairs.  
Dermatitis in dogs, cats, rabbits, man.  
Direct or indirect contact, furniture.  
Control: hoovering, washing,  
Insecticides: shampoo for dogs,  
anti-flea spot-on, fipronil, ivermectin.





## ***Pyemotes* (*P. tritici*, *P. ventricosus*)**

Insect parasites, viviparous, nymphs develop in female abdomen.  
During outbreaks of moths, or other pests, toxins in salivary glands.  
Dermatitis and „grain itch“ in humans and horses.



***Acarapis woodi*** (Tarsonemidae)  
Tracheal mite (*roztočik včelí*)  
in honey bees, affect flight activity  
Fumigation with formic acid.





# Acaridida (Astigmata, Sarcoptiformes): zákožky

Small (0,2-1 mm) mites, various genera cause scabies or mange in domestic and laboratory animals, mainly mammals. Psoroptidae: non-burrowing (*prašivina*) *Psoroptes*, *Chorioptes*, *Otodectes*. Hypersensitive reactions, crusts, scratching, immunosuppression.

## *Psoroptes cuniculi*:

Rabbits, ears, head,  
Noninfective to humans  
*P. ovis* : mange in sheep, cattle.



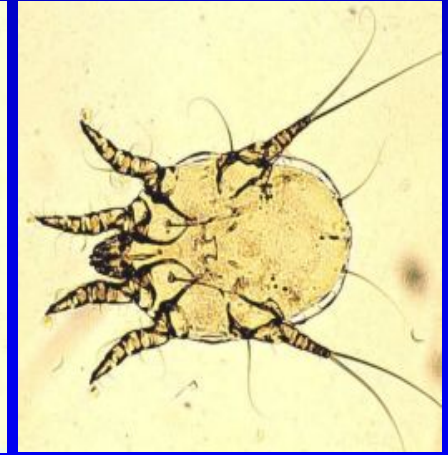
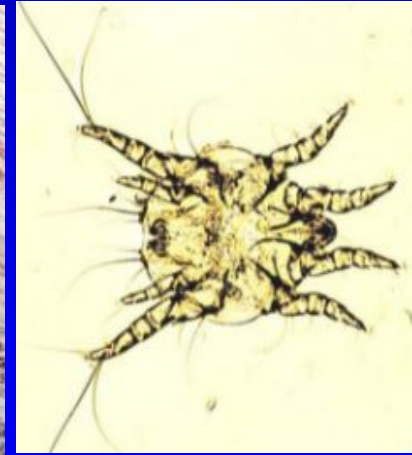
## *Chorioptes bovis*

## *Otodectes cynotis*:

mange in dogs and cats,

Burrowing mites (*svrab*)

*Notoedres cati*: biology similar to *S. scabiei*, mange in cats, mainly head and ears, skin crusts, hairs fall, highly contagious in cats, transient dermatitis in humans, other species in rats and mice



## ***Knemidocoptes:***

the burrowing mites of birds.

Spread by prolonged contact, dormant for a long time.

Several species cause diseases with various clinical signs.

*K. mutans* (*lupovka kuří*): scaly legs (*vápenka*)

*K. gallinae*: depluming itch, loss of feathers and weight

*K. pilae*: scaly beak and face in parakeets





## ***Sarcoptes scabiei* : scabies (svrab, zákožka svrabová):**

up to 70% prevalence (Bangladesh), 14 day life cycle, proto and tritonymph. Females make burrow (1-5 mm per day), other life stages on surface or in hair follicles. Transmission: fertile females, close contact (sex), sharing cloths, towels, lining. Other *Sarcoptes* species in other mammals (morphology x physiology), *S. suis*. Dermatitis present across most of the body or just in certain areas such as the wrists, between fingers (not in face and neck). Symptoms due to hypersensitive reaction usually after 1-2 months, in recidiva in few days.

The itch often worse at night.

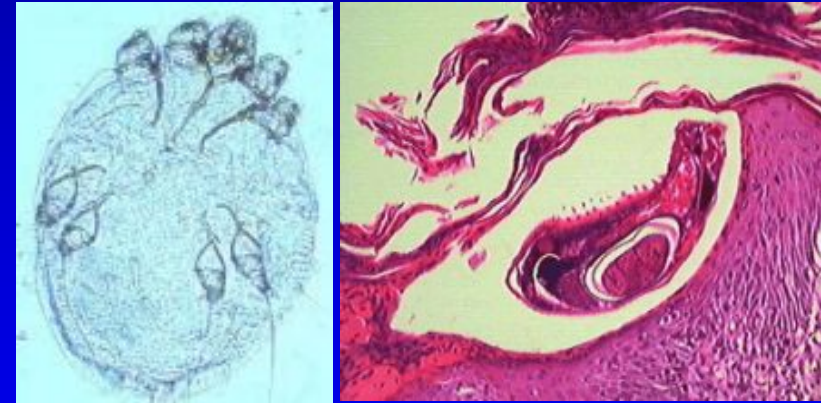
Danger of secondary bacterial infection.

Scabies crustosa: a more severe form of the disease. Typically only in immunosupressed people, millions of mites, more contagious.

Diagnostics difficult: specific IgE, eosinofilia.

Skin excision (5 min. 5% KOH, then boric acid), microscopical detection: mainly eggs. Treatment by insecticides Infectoscab (permethrin, cream or lotion), Scabioral (ivermectin, oral tablets).

Treat all persons in the same household.

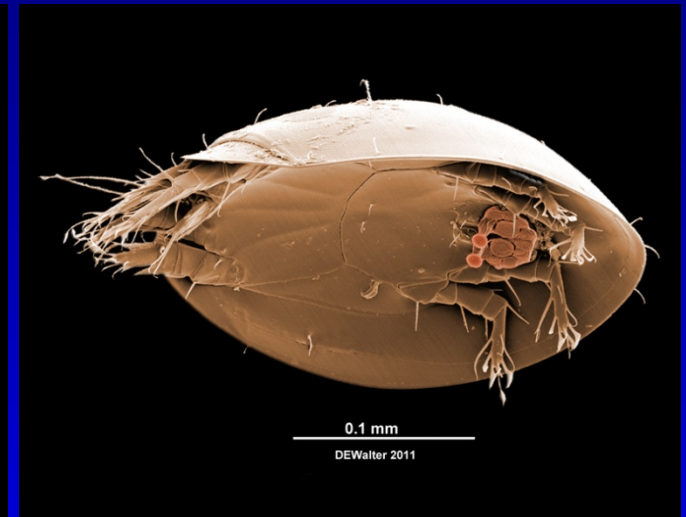
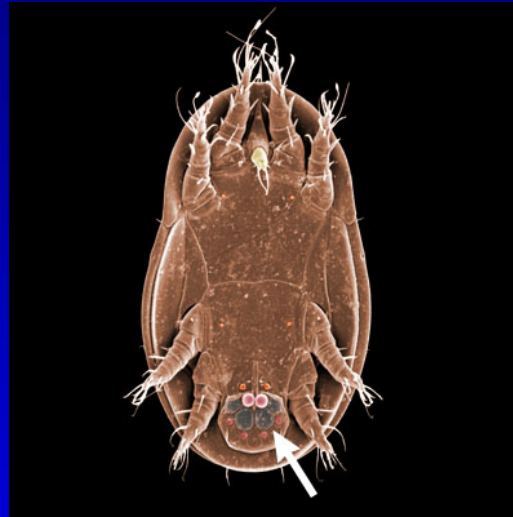




# Acarididae + Glyciphagidae

Storage mites, allergenic by contact, suffocation, inhalation, asthma

***Acarus*** (and some others)  
(deuto)nymph = hypopus:  
encased in protonymphal skin.  
Hard body wall, resistant to  
environmental conditions.  
Suckers on the underside  
Spread by air, foresis



***Tyrophagus***  
feeds on animal proteins,  
pest in stores and insect colonies.  
without hypopi.  
Biological control:  
Cheiletidae – Amblyseilus



# Pyroglyphidae

Up to 0.3 mm, Feather or dust mites,  
Feed on feathers, keratin

Originally in bird nests

Adaptation to houses, prefer

Higher humidity (more than 50%)

In bed, mattresses, carpets

Causing asthmatic allergies.

Inhalation of debris and feces. About 5 genera, *Euroglyphus*, *Blomia*,

***Dermatophagoides***: *D. pteronyssinus* (Europe), *D. farinae* (America).

Allergens: fecal pellets with cysteine proteases. Allergy herited in 50-80%.

Diagnostics: cutaneous tests for allergy, IgE ELISA, desensitization,  
antihistaminics. Acares test for dust, detection of guaninu.

hoovering, modern mattresses and lining from microfiber.

Hoovers with good quality filters. Carpets versus other floor cover.

Acarophobia.

