Other disease vectors



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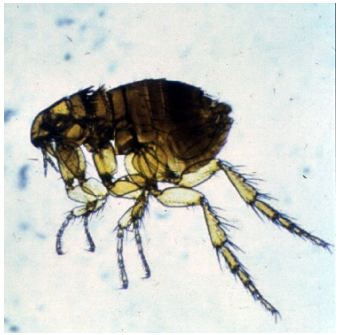
Other disease vectors



- **Fleas** bite: *Yersinia pestis* (plague), *Rickettsia typhi* (murine typhus), *R. felis* (flea spotted fever), *Bartonella henselae* (cat scratch disease)
  ingestion: *Dipylidium caninum* (dipylidiasis), *Hymenolepis diminuta* (hymenolepiasis)

- **Human lice**: body lice: *R. prowazekii* (epidemic typhus), *Bartonella quintana* (trench fever), *Borrelia recurrentis* (relapsing fever), *Acinetobacter baumannii* (?)
  head lice: *B. quintana* (?)

Other disease vectors

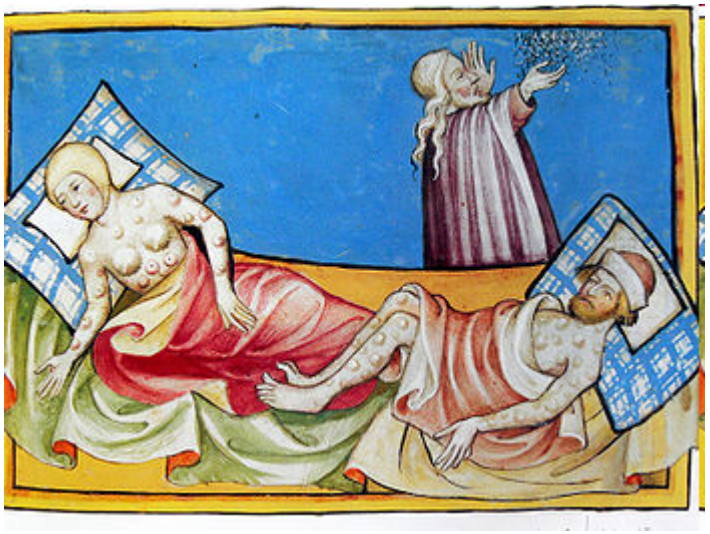
- Flies: fly larvae (myiasis)
  - *Thelazia callipaeda* (eye worm)
  - *Wohlfahrtiimonas chitiniclastica* (bacteremia)
  - *Ignatzschineria larvae* (bacteremia)

- Putative vectors
  - Bed bugs, *Cimex lectularius*
  - Biting midges, *Culicoides* sp.

Problems

- Widespread vectors
- Mostly mild and not reportable diseases
- => no surveillance systems => scarce data
- Scientific literature search 2000-2010
- Report at the country level (N 0)

Flea-borne infections



Plague

- *Yersinia pestis*

- Transmitted by the rat flea *Xenopsylla cheopis*

- Black death: a major cause of death in European history (3 outbreaks). Eradicated since the 19th century

- Currently endemic in Asia and Africa

Murine typhus

- *Rickettsia typhi*

- Transmitted by the rat flea *Xenopsylla cheopis* (also *Leptopsylla segnis* in Portugal)

- Headache, fever, chills, myalgia, nausea, vomiting, and cough

- Mostly mild

- Geographic distribution: Croatia, Cyprus, Greece, Portugal (Madeira), Spain (incl. Canary islands)

(Bernabeu-Wittel *et al.* Arch Intern Med.1999;159:872-6, La Scola *et al.* Clin Diag Lab Immunol.2000;7:612-6, Andre *et al.* Acta Med Port.1998;11:81-5, Tselentis *et al.* Am J Trop Med Hyg.1996;54:413-7)

Flea spotted fever

- *Rickettsia felis*

- 2010: 70 cases
- Fever: 100%
- Eschar in 20%
- Grouped cases in 20%
- Rash is present in half of cases
- Rare: photophobia, hearing loss, meningitis

Flea spotted fever

(Socolovschi *et al.* Emerg infect Dis 2010; in press)

- Rural Senegal
- Low grade fever (mean 38.6°C)
- No rash, no eschar
- Mean age 15 y-o (2 – 57 y-o)
- Systematic PCR for *R. felis* from blood
- 134 patients with unexplained fever (malaria-negative)
- 8 patients PCR-positive (6%)
- Confirmed by 2 PCR distinct specific assays
- One patient had 2 positive blood specimens collected 1.5 months apart (chronic infection? Reinfection? Relapse?)
- Flea spotted fever may cause aneruptive fever

Distribution of *Rickettsia felis* in arthropods

PubMed search 1990 – April 2010

Fleas

- *Ctenocephalides felis* +++
- *Ctenocephalides canis*
- *Xenopsylla cheopis*
- *Xenopsylla brasiliensis*
- *Archaeopsylla erinacei*
- *Spilopsyllus cuniculi*
- *Echidnophaga gallinacea*
- *Anomiopsyllus nudata*
- *Pulex simulans*
- *Pulex irritans*
- *Ctenophtalmus* sp.
- *Tunga penetrans*

Ticks

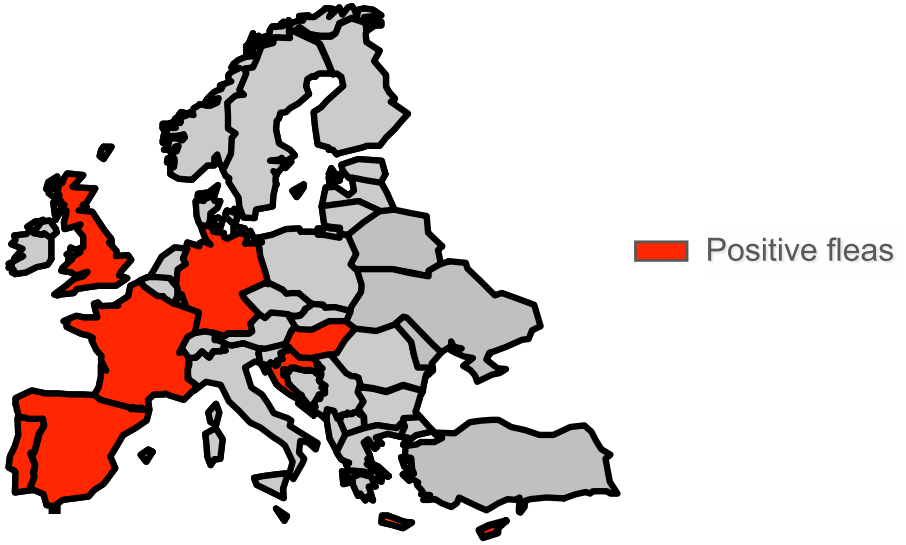
- *Haemaphysalis flava*
- *Haemaphysalis kitaokai*
- *Haemaphysalis sulcata*
- *Rhipicephalus sanguineus*
- *Amblyomma cajennense*
- *Ixodes ovatus*

Mites

Other: *Liposcelis bostrychophila*

Infested animals: cats and dogs++, opossums, rodents, hedgehogs, gerbils, monkeys, horses, sheep, goats, Pelican

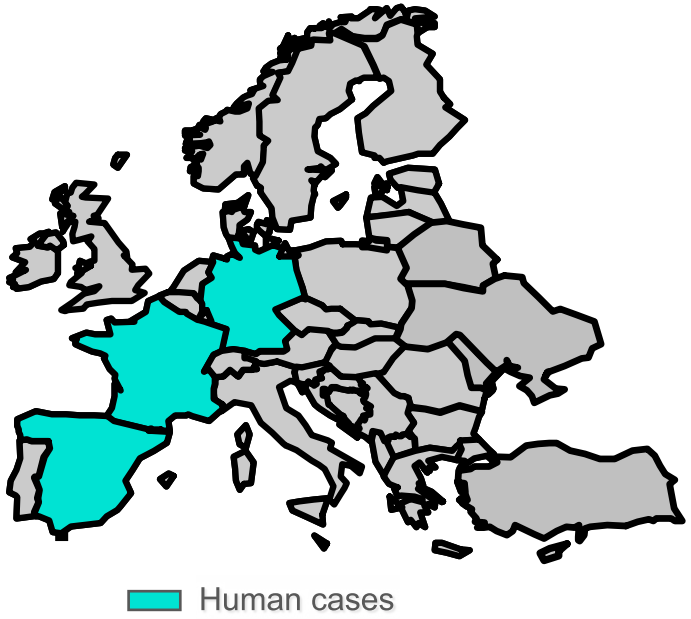
Geographic distribution of *Rickettsia felis* in fleas



- *Ctenocephalides felis*: Croatia, Cyprus, France, Germany, Great Britain, Spain
- *Ctenocephalides canis*: France, Spain
- *Archaeopsylla erinacei*: France, Germany, Portugal
- *Pulex irritans*: Hungary

(Gilles *et al.* Emerg Infect Dis.2008;14:684-6, Gilles *et al.* Emerg Infect Dis.2008;14:1294-6, Márquez *et al.* Ann N Y Acad Sci.20061078:344-6, Shaw *et al.* Vet Microbiol. 2004;102:183-8)

Geographic distribution of flea spotted fever



- Human cases: France, Germany, Spain (incl. Canary islands)

(Renvoise *et al.* Emerg Infect Dis. 2009;15:1126-7, Nogueras *et al.* Ann N Y Acad Sci. 2006; 1078:159-61, Richter *et al.* Emerg Infect Dis. 2002;8:207-8)

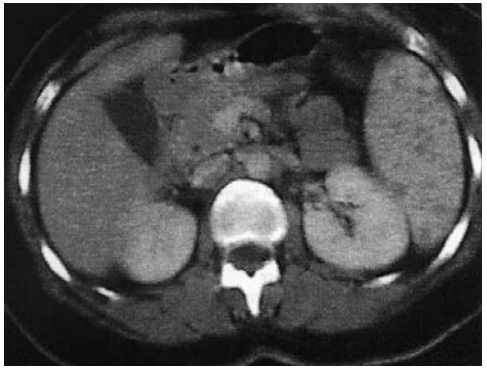
Cat scratch disease

- *Bartonella henselae*

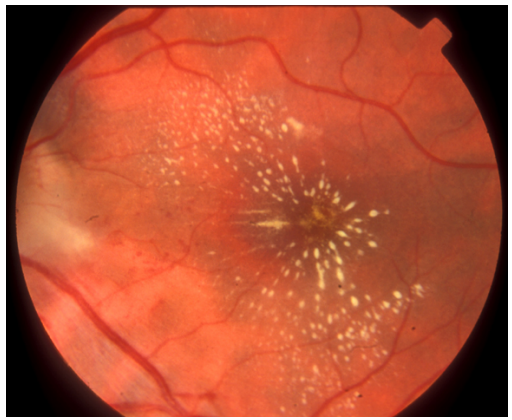
- Mostly transmitted by cat scratches or bites
- Less commonly by cat flea bites
- The most frequent *Bartonella* infection
- 80% ≤18 years
- Mild disease (Carithers. Am J Dis Child. 1985;139:1124-33)
- Primary inoculation lesion
- Regional lymphadenopathy (90% of cases): axilla > neck > groin
- Self limited, 2 – 6 months
  (Margileth. Adv Pediatr Infect Dis. 1993;8:1-21)

Cat scratch disease

- 50% fever ≤ 39°C, malaise, weakness
- 10%: local suppuration => needle aspiration



- Rare forms: bacteremia, hepatic or splenic abscess, osteomyelitis, pneumopathy, erythema nodosum, meningo-encephalitis, Parinaud's syndrome (unilateral conjunctivitis + pre-auricular adenitis), Leber's neuroretinitis (stellate macular exudates) (Reed et al. Ophtalmology. 1998;105:459-66 Suhler et al. Ophtalmology. 2000:107:871-6)



- Neurological complications ~ 1-2% of CSD cases (Carithers. Am J Dis Child. 1985;139:1124-33 Carithers & margileth. Am J Dis Child. 1991;145:98-101)

Bartonella endocarditis

- *B. henselae* +, *B. quintana*++
- Blood culture negative endocarditis
- No specific clinical presentation
- extensive valvular damage

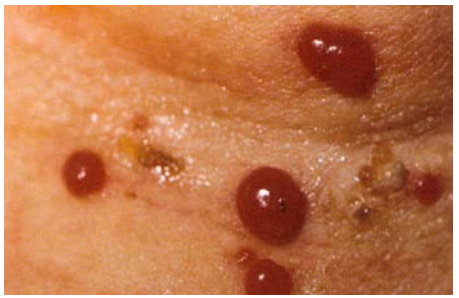
(Fournier PE al. Medicine 2001; 80:245-51
Raoult et al. Arch. Intern. Med.
2003;163:226-30)

Bacillary angiomatosis

- *B. henselae* and *B. quintana*

Stoler et al. Am J Clin Pathol. 1983;80:714-8
Koehler et al. Clin Infect Dis. 1993;17:612-24

- Immunocompromised patients (AIDS ++)
- Unique or multiple papules, most often red, sometimes ulcerated, bleeding, frequent satellite adenopathies

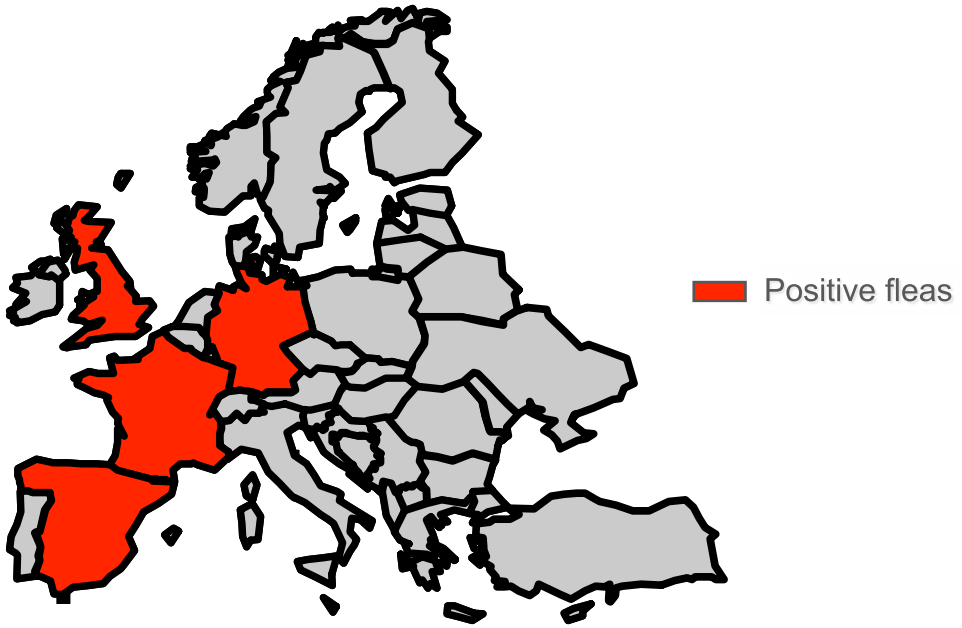


- Visceral involvement : liver, spleen, lymph nodes, brain, heart, muscle, bone marrow

Koehler et al. Clin Infect Dis. 1993;17:612-24

- Without treatment, the evolution is most often fatal

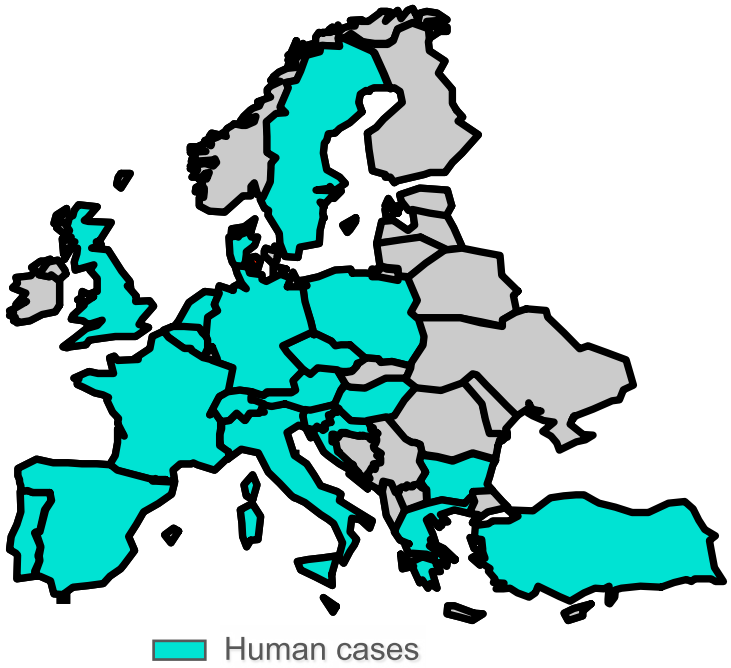
Geographic distribution of *B. henselae* in *C. felis* in Europe



- France, Germany, Great Britain, Spain

Just *et al.* Zoonoses Public Health. 2008;55:514-20,
Hornok *et al.* Vet Microbiol.2010;140:98-104, Shaw *et al.*
Vet Microbiol. 2004;102:183-8)

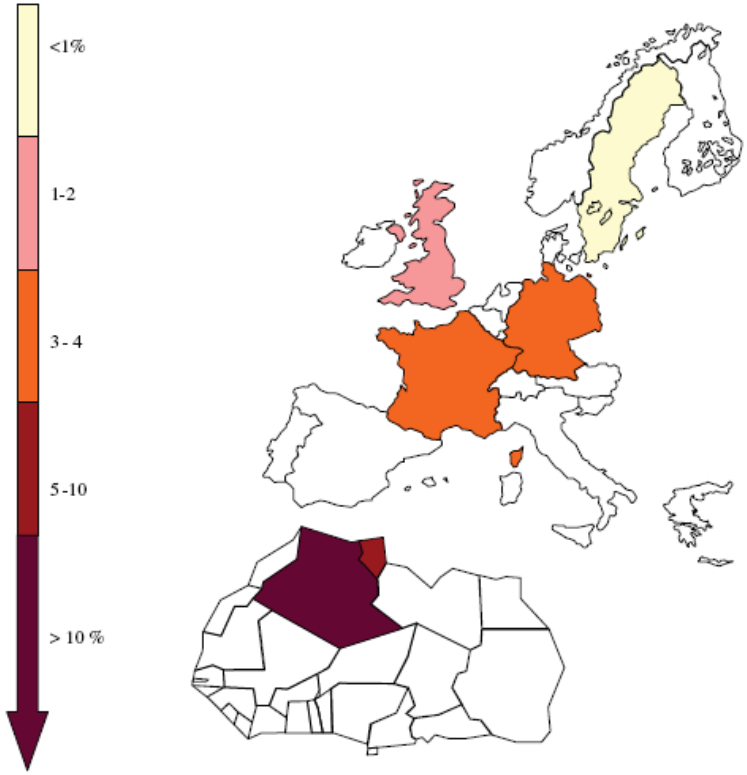
Geographic distribution of *B. henselae* infections in Europe



- Human cases: Austria, Belgium, Bulgaria, Croatia, Czech Republic, France, Germany, Greece, Great Britain, Hungary, Italy, Poland, Slovenia, Spain, Sweden, Switzerland, The Netherlands

Geographic distribution of *B. henselae* in Europe

- *Bartonella henselae* endocarditis
- North-South prevalence gradient
- Are cat flea-associated infections present in colder countries?

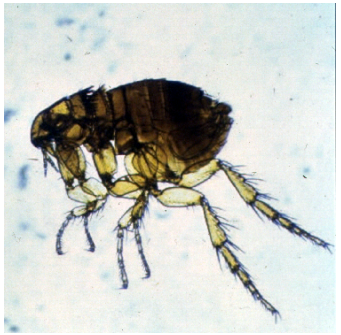


Brouqui and Raoult. FEMS Immunol. Med. Microbiol. 2006;47:1-13

Dipylidium caninum

- Cucumber tapeworm

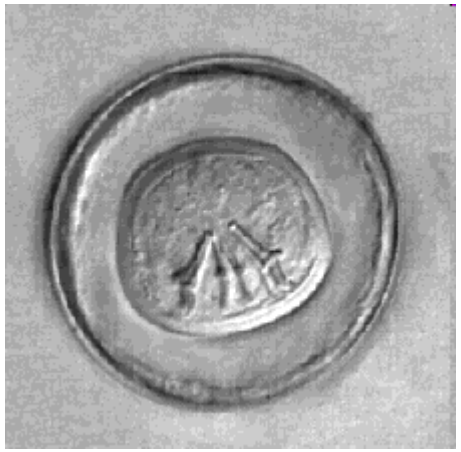
- Dypilidiasis
- Main host: cats, dogs
- Vectors: *Ctenocephalides felis*, *C. canis* (*Siphonaptera*: *pulicoidea*)



- Frequent, worldwide distribution
- Exposed population: mostly children < 8 y-o

Hymenolepis diminuta

- Rat tapeworm



- Hymenolepiasis
- Main host: rats
- Vectors: *Xenopsylla cheopis* (*Siphonaptera*: *pulicoidea*)

- Rare, geographic distribution: Spain, Italy, Greece (Antoniou *et al.* Vector Brone Zoonotic Dis. 2010;epub)
- Exposed population: mostly children

Louse-borne infections

Epidemic typhus

Bechah *et al.* Lancet Infect Dis. 2008l;8:417-26

- *Rickettsia prowazekii*
- Transmitted by the body louse *Pediculus humanus humanus* (*Phthiraptera*: *pediculidae*)
- Endemic in Europe until WWII, then eradicated
- But: - Outbreak in Russia (Tarasevich *et al.* Lancet. 1998;352:1151)

  - Imported cases from Algeria (Mokrani *et al.* J Clin Microbiol.2004;42:3898-900)

Relapsing fever

Cutler. Emerg Infect Dis 2006;12: 369–74

- *Borrelia recurrentis*
- Transmitted by the body louse
- Epidemic in Europe until the 1930s, then eradicated
- Currently restricted to Sudan and Ethiopia

Trench fever

(Byam et al. Oxford University Press. 1919)

- *B. quintana*
- *Pediculus humanus corporis*
- Most cases: fever with a brutal onset, headache and invalidating muscle pain, sweats, and conjunctive injection
- 4-5 days episodes, separated by 4-5 days intervals
- 3-8 relapses, attenuation of symptoms during recurrences

The return of trench fever

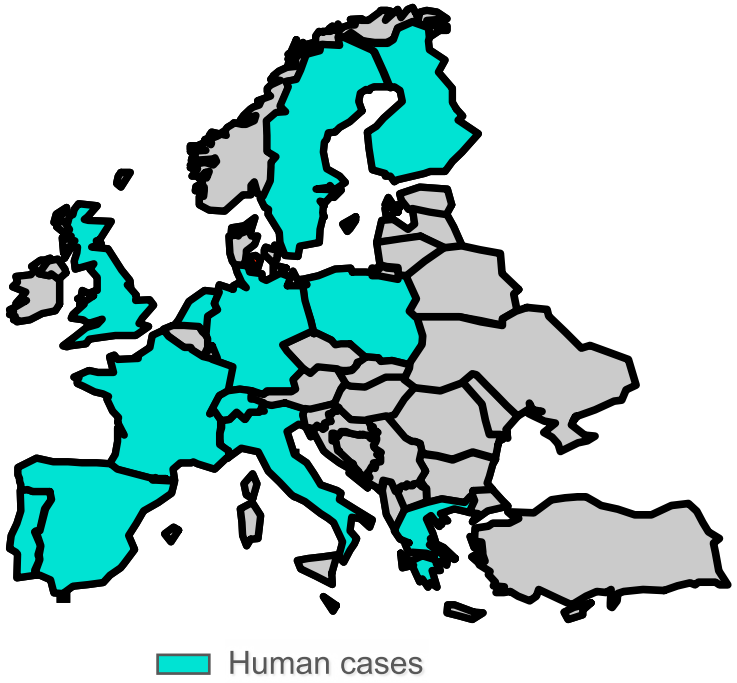
(Spach et al. N Engl j Med. 1995;332:424-8
Stein & Raoult. Lancet. 1995;345:450-1
Brouqui et al. N Engl J Med. 1999;340:184-9)

- Industrialized countries: homeless people
- Infested with body lice
- Fever and weight loss
- Persistant bacteremia for months without treatment
- 5.3% of homeless in Marseille

(Brouqui *et al*. Medicine. 2005;84:61-8)

- Also causes bacillary angiomatosis, endocarditis, chronic bacteremia

Geographic distribution of *B. quintana* infections in Europe



- In body lice: only studies from France and Russia (Moscow area)
- Human cases: Finland, France, Germany, Great Britain, Greece, Italy, Poland, Portugal, Spain, Sweden, Switzerland, The Netherlands

May *Acinetobacter baumannii* be transmitted by the body louse ?

Fournier *et al.* PLoS Genet. 2006;2:e7
La Scola *et al.* J Clin Microbiol. 2001;39:1707-9

- A clonal strain of antibiotic-susceptible *A. baumannii* in homeless body lice
- Evidence of *A. baumannii* infections in homeless (Chen *et al.* Chest 2001;120:1072-7)
- *A. baumannii* does not kill the louse (Houhamdi and Raoult. Am J Trop Med Hyg. 2006;74:526-31)

May the head louse transmit human infections ?

Bonilla *et al.* Emerg Infect Dis. 2009;15:912-5

- *P. humanus capitis* is widely distributed in children in Europe
- Taxonomic status unclear
- Genetically undistinguishable from the body louse
- Presence of *B. quintana* in *P. humanus capitis* in the USA and France in homeless, in Nepalese school children => risk of outbreak?

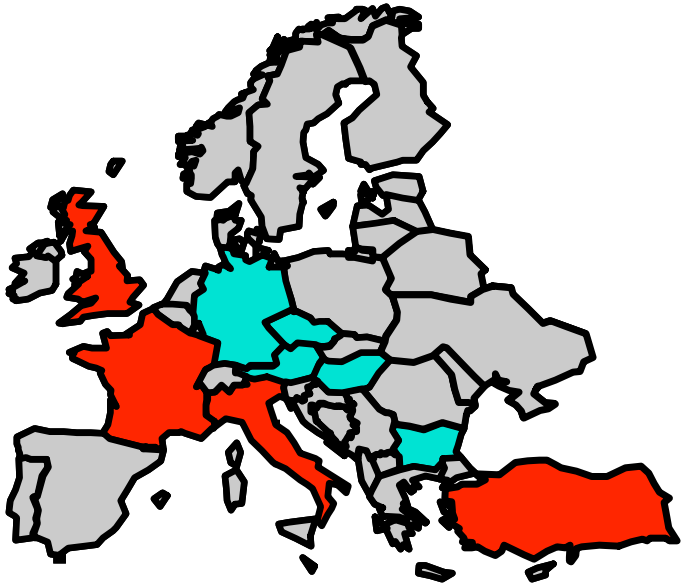
Fly-borne diseases

Myiases (*Diptera*)

- Wound myiases in sheep, cattle, goats, horses
- Rare in humans
- Furunculoid lesions, may also develop in wounds and certain body cavities

- Larvae from the flies *Calliphora vicina*, *Cordylobia* sp., *Lucilia sericata* (Family *Calliphoridae*), *Eristalis tenax* (*Syrphidae*), *Oestrus ovis* (*Oestridae*), *Wohlfahrtimonas chitiniclastica* (*Sarcophagidae*)
- Exposed population: homeless, poor hygiene

Geographic distribution of *Lucilia sericata* in Europe

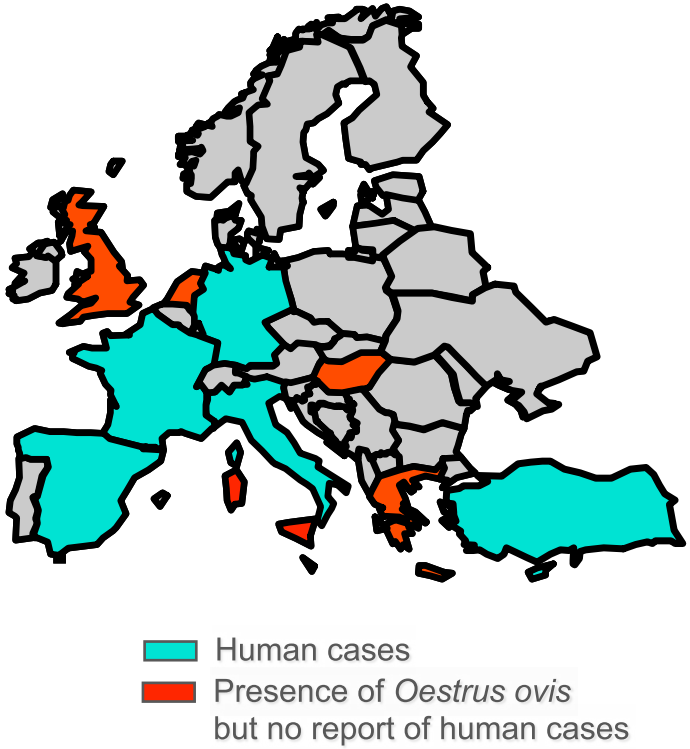


Human cases
Presence of *Lucilia sericata* but no report of human cases

- Used in the treatment of chronic suppurative wounds ("maggot debridement therapy")

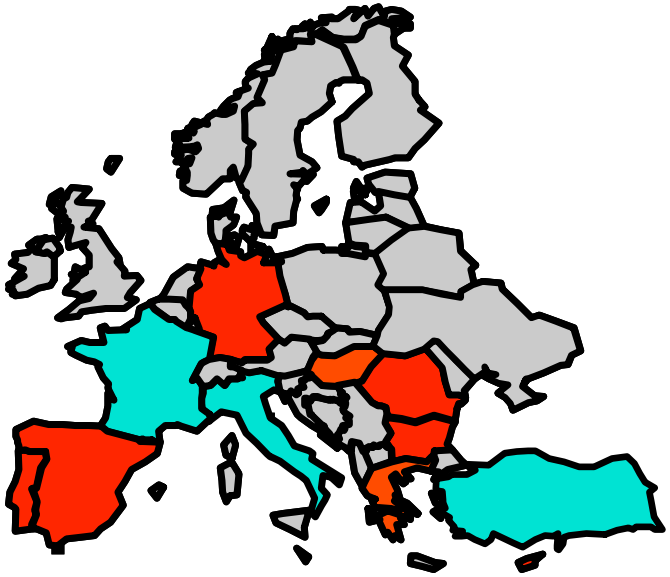
- Human cases: Austria, Bulgaria, Czech Republic, Germany, Hungary, Malta

Geographic distribution of *Oestrus ovis* in Europe



- Human cases: Cyprus, France, Germany, Italy, Malta, Spain, Turkey (Gatt and Zammit. Bull Entomol Soc Malta.2008:1:5-10)

Geographic distribution of *Wohlfahrtia magnifica* in Europe

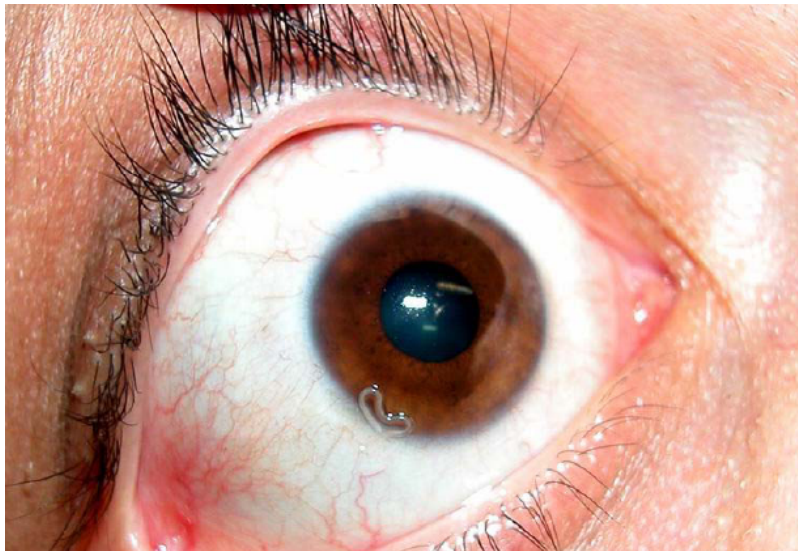


➢ Human cases: southern France, Italy, Tukey (Ruiz Martinez and Leclercq. Notes Fauniques Gembloux.1994:28:53-60)

Human cases of *Calliphora vicina*, *Cordylobia* sp. , *Eristalis tenax* in Europe

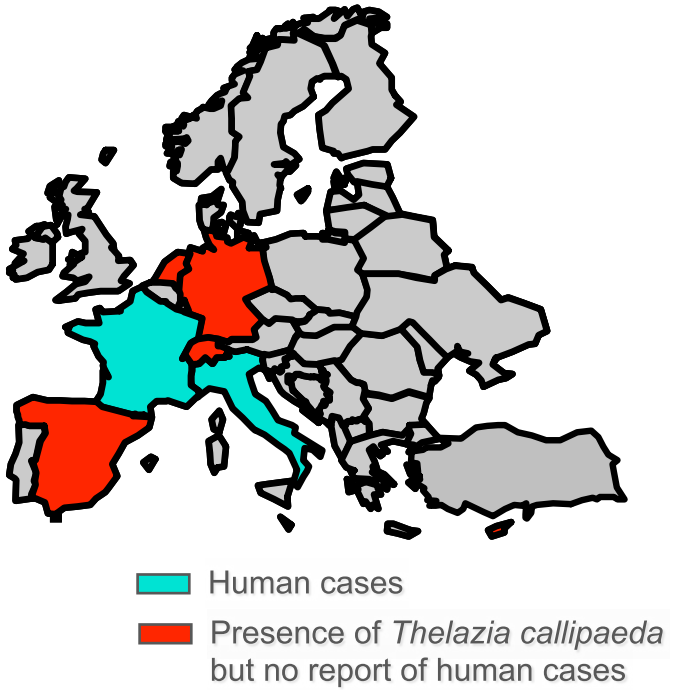
- One human case each in Portugal, France and Belgium, respectively

Thelazia callipaeda



- Parasitic nematode
- Eyeworm or thelaziasis
- Mostly dogs and cats, rarely humans
- Mild to severe irritation leading to lacrimation discharges, conjunctivitis, keratitis and corneal urcers
- Vectors: *Phortica variegata* (*Diptera*: *Drosophilidae*)

Thelazia callipaeda



- Human cases: France, Italy (Otranto and Dutto. Emerg Infect Dis. 2008;14, Roggero *et al.* Vet Parasitol. 2010;in press)

- Exposed population: homeless

Wolfahrtiimonas chitiniclastica
Ignatzschineria larvae

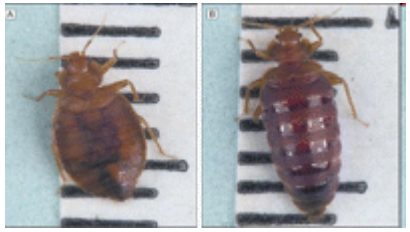
- γ-Proteobacteria, symbionts of their vectors
- Vectors: *Wohlfahrtia magnifica* larvae (maggots)

- Bacteremia in patients with myiasis
- Geographic distribution: southern France (Rebaudet *et al.* Emerg Infect Dis.2009;15:985-987, Maurin *et al.* Emerg Infect Dis.2007;13:657-659, Roudiere *et al.* Emerg infect Dis.2007;13:659-661)
- Exposed population: homeless, poor hygiene

Bed bugs

Cimex lectularius

- Bed bug
- *Hemiptera*: *Cimicidae*



- Readily bite humans for blood meals
- Frequent, worldwide distribution (sheets, mattresses)
- Exposed population: any (trains +++)
- Controversial role in disease transmission: HIV, HBV in Europe (Goddard and deShazo. JAMA.2009;301:1358-1366)

Culicoides sp.

- Biting midges
- *Diptera*: *Ceratopogonidae* (~500 species)
- Vectors of various microorganisms: viruses (bluetongue, Akabane, Aino, Oropouche), parasites (*Mansonella* sp., *Onchocerca* sp., *Plasmodium agamae*)
- Endemic in Europe, but don't carry human pathogens
- Existing surveillance network: EUBTNET http://eubtnet.izs.it/btnet/index.htm

Conclusion - perspectives

- Widespread vectors
- Mostly mild and not reportable diseases
- => no surveillance systems
- Data of unequal quality
- Missing in many countries
- Need diversified input (veterinarians)
- Need to include potential vectors? (*Cimex, Culicoides*)