SOME VECTOR-BORNE PATHOGENS AFFECTING CATS ARE OF ZOONOTIC CONCERN

- *Rickettsia felis* is responsible for the flea-borne spotted fever which is characterised by fever and a cutaneous rash.
- *Anaplasma phagocytophilum* causes granulocytic anaplasmosis in humans. The average seroprevalence in Europe is about 8%, and can reach 30%[19].
- *Bartonella henselae* is the agent of bartonellosis in humans, which is most often limited to a regional lymphadenopathy. Fever and malaise can be observed in some cases.
- Haemoplasma infections have been described in immuno-compromised people[21] but further epidemiologic studies are needed to understand the zoonotic potential of *M. haemofelis*.

Cats play no direct role in the transmission of vector-borne pathogens to humans for whom infection is related to tick or flea bites, but cats can be considered as sentinels for human exposure[25].

The only exception is *Bartonella* spp., which is transmitted by cat bites and scratches, hence the name "cat scratch disease".

CATS SEEM TO BE LESS FREQUENTLY INFECTED BY VECTOR-BORNE PATHOGENS THAN DOGS.

To date, only hypotheses have been raised to try to explain this phenomenon. One of them is that **cats could have a genetically-determined immunological resistance to the vector or to the pathogens they transmit**[6]. Nonetheless, further research is needed to have a better estimation of the prevalence and clinical significance of vector-borne diseases in cats. In addition, **most seropositive cats appear to be clinically healthy** or show nonspecific clinical signs.

As diagnosing vector-borne diseases in cats can be challenging, and because some of them are zoonotic, tick and flea control is important, especially in cats having outdoor access.

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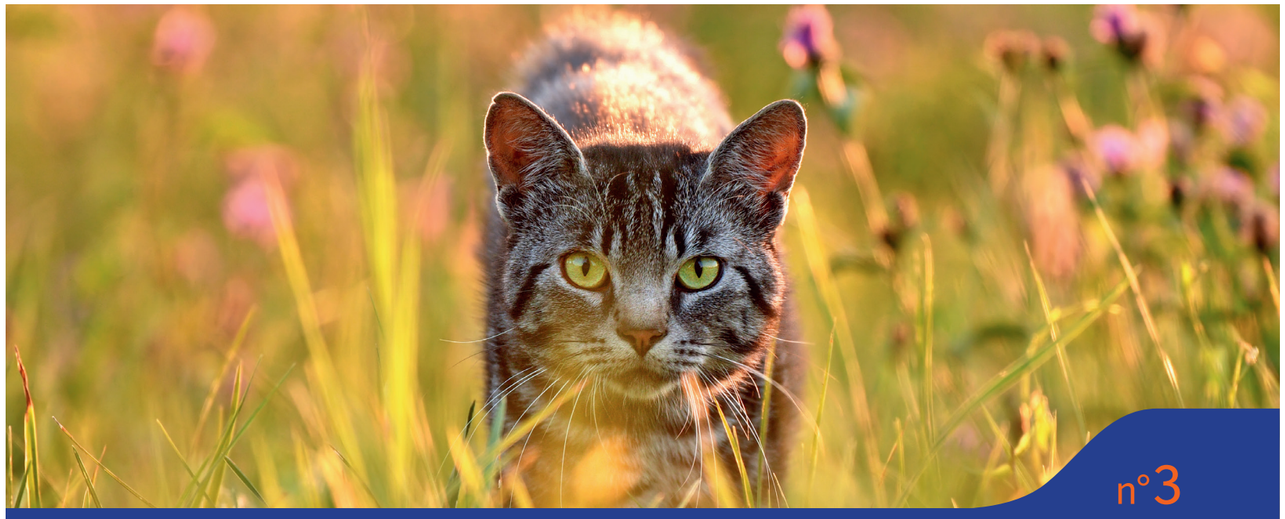
TECHNICAL BULLETIN



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MAIN VECTOR-BORNE DISEASES IN CATS

Compared to dogs, cats seem to be less at risk of being infested by ticks. Their efficient grooming may play a role as mechanical removal, as well as their way of life, which may not bring our domestic cats close to the natural habitats of ticks. In the end, cats are usually not the preferred tick hosts.
But surveys worldwide show that they are nevertheless at risk of tick infestation[3,16], and therefore exposed to tick-borne diseases[5,7,24,25], sometimes even when their owners qualify them as indoor cats[16]. When it comes to fleas, it is well-known that cats may be infested at any time whatever their lifestyle, and therefore infected by flea-borne pathogens[12,22,23].

Pathogens may be transmitted during flea feeding

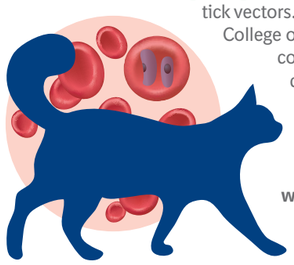
Engorged *Ixodes ricinus* ticks

FLEA AND TICK -BORNE PATHOGENS

BACTERIAL INFECTIONS

Rickettsial agents are mainly transmitted by *Ixodes* spp., but also by ***Rhipicephalus*** spp. ticks. Among them, ***Anaplasma phagocytophilum*** **is the most important one in felines.** Indeed, 19% of ***Ixodes*** ticks were found positive to this agent in Europe[4,9].

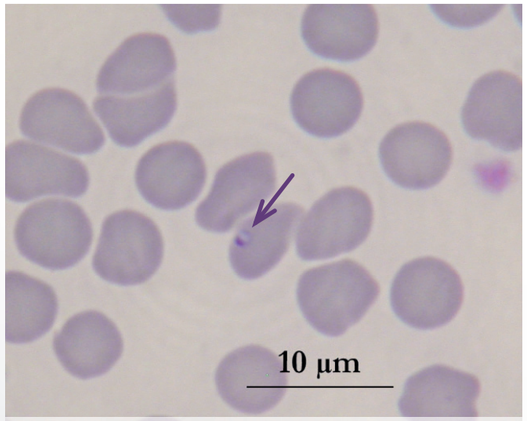
FLEA AND TICK -BORNE PATHOGENS



Regarding *Borrelia* spp., *Ixodes* species are the tick vectors. The latest ACVIM (American College of Veterinary Internal Medicine) consensus states that although cats may be seropositive, it is **unknown if *Borrelia burgdorferi* infection causes illness** in cats, and that **coinfections (especially with *A. phagocytophilum*) must be considered** in those with suspected Lyme borreliosis[17].

Rickettsia felis and *Bartonella henselae*, the agents of the **flea borne spotted fever** and of the **cat scratch disease in humans** respectively, are transmitted by fleas. Cats are the main reservoir for *B. henselae*. For both pathogens, **most infected cats do not show any clinical signs** except if they are immunocompromised. In Europe, some studies found that 28.8 to 96.4% of fleas were positive for at least one investigated pathogen, with the highest prevalence found in southern Italy[22,23].

Haemoplasmas (*Mycoplasma* spp.) are the agents of feline infectious anemia in cats and are not zoonotic. The mode of transmission of haemoplasmas is not known, but aggressive interactions between cats and vectors, such as *Ctenocephalides felis*, are possibilities[20]. In the UK, haemoplasma DNA has been amplified from 50% of the flea samples[23].



Cytauxzoon sp. Courtesy from Luc Chabanne

PROTOZOAL INFECTIONS

Feline babesiosis is rare and is transmitted by different tick species. Babesiosis is caused by protozoans of the *Babesia* genus, infecting red blood cells and causing **hemolytic anaemia**. Yet, cats seem to be less susceptible to babesiosis than dogs. ***Babesia felis***, a small form of *Babesia*, **induces the most severe disease**.

Cytauxzoon species are piroplasms infecting the red blood cells. They are transmitted by ticks (*Amblyomma americanum* in the USA, and probably *Ixodes* ticks in Europe) therefore most cases occur from spring to early autumn. For years, cytauxzoonosis in domestic cats has been only reported in **North and South America, but the infection has also been observed in Europe recently** (Spain, France and Italy). *Cytauxzoon felis* infection is the most common vector borne disease diagnosed in cats in the USA. The reservoir of *Cytauxzoon* spp. are wild felids like Bobcats and Lynx.

VECTOR-BORNE PATHOGENS ARE TRANSMITTED IN A COUPLE OF HOURS OR DAYS TO CATS[2,15,27]

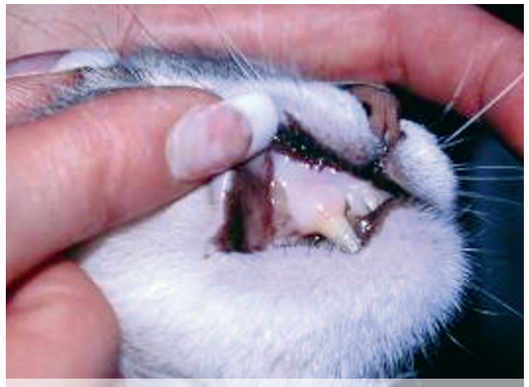
- Pathogens can be transmitted throughout the whole blood meal.
- **Rickettsial species are directly infective** in tick saliva and are inoculated within 3 to 24 hours after attachment.
- ***Babesia* and *Cytauxzoon*** sporozoites must become infective and pass across the salivary glands. They are **usually transmitted beyond 48 hours after tick attachment.**

CLINICAL AND LABORATORY DIAGNOSIS MAY BE CHALLENGING BECAUSE...

... Cats can be asymptomatic carriers of vector-borne pathogens. When clinical signs are observed, there are usually non-specific[10,18,20,26]

- Rickettsial species, including ***Anaplasma* spp., cause non-specific clinical signs**, consisting in fever, anorexia and lethargy which are usually reported soon after tick infestation.
- **Haemoplasmas are responsible for anaemia**, but infected cats often undergo subclinical infections. Nevertheless, primary infection or reactivation in a previously infected cat may result in **non-specific clinical signs** such as lethargy, weakness, reduced appetite, dehydration, weight loss and intermittent pyrexia. ***Mycoplasma haemofelis* infection can result in severe haemolytic anaemia and lead to the death of the cat.** It is the most pathogenic haemoplasma species: the other two species, *Candidatus Mycoplasma haemominutum* and *Candidatus Mycoplasma turicensis*, usually induce anaemia only in immunocompromised cats.
- Feline ***Babesia* species cause mild clinical signs, except *Babesia felis*,** the most important pathogenic species in cats, which has been mainly reported in South Africa. Cats that recover from the disease generally remain chronic carriers.
- Whereas it is a **mild disease in Europe, cytauxzoonosis is a severe disease in the USA,** causing a severe febrile syndrome and hemolytic anaemia, **associated with a high death rate.** Surviving animals become asymptomatic reservoirs.

Immune-mediated hemolytic anemia (IMHA) is associated with most vector-borne infections in cats[8,10,26], especially infection by piroplasms (*Babesia felis* and *Cytauxzoon felis*)[1].



Pale mucous membrane in an anaemic cat. Courtesy from Jane Sykes.

Whatever the vector-borne pathogen, **fever, anaemia (lethargy, pale mucous membranes...) and/or thrombocytopenia** are part of the few clinical signs that **could orientate the diagnosis[13,14]**.

Cats exposed to, or with a history of flea and/or tick infestation and presenting a febrile syndrome should be screened for vector-borne diseases, especially if they do not receive a regular protection against ectoparasites.

... Blood smears do not always reveal an infection[10,18,20,26]

Intracytoplasmic inclusion bodies (morulae) are found in *Anaplasma* and *Ehrlichia infections*. ***A. phagocytophilum* inclusion bodies are found in 1-24% of infected cat blood smears.**

Blood smears may reveal **haemoplasmas on the surface of red blood cells,** but this method is **very insensitive**.

***Cytauxzoon* spp. can be observed in blood smears** and/or fine-needle aspirates from the liver, spleen and lymph nodes using rapid Romanowsky-type stains.

The direct examination of blood smears is the method of choice to diagnose babesiosis in dogs, but **feline *Babesia* are more difficult to detect** through this method due to a **frequent low level of parasitemia.**

... Detection of antibodies or PCR are sensitive methods to detect vector-borne pathogens[10,18,20,26].

PCR can confirm a hypothesis of feline VBP infection, demonstrating that the pathogen's DNA is present in the blood sample. Regarding *Anaplasma* and *Ehrlichia* infections, PCR has to be performed during the acute phase of the disease, before starting any antibiotic treatment. This method may be not very convenient in practice as it is **not a quick in-clinic diagnostic tool.**

Immunofluorescence and ELISA techniques can be used to detect rickettsial antibodies, but **cross-reactions** can occur, and the method is **not optimal in detecting acute infections** as approximately two weeks are needed to develop a humoral immune response.