ONE HEALTH AND RISING TEMPERATURES

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THERE IS A CONNECTION...

between the health of people, animals, and our shared environment. Many of the parasites and diseases that you diagnose and treat are also important zoonoses. Vets play a major role in educating pet owners about these threats. Vets should also collaborate with human and environmental health services to tackle major challenges, such as vector-borne diseases (VBDs), antimicrobial resistance, and zoonoses. Pet owners think of protecting their pets during vectors' high activity months.

However, due to rising temperatures, parasites are staying active for longer throughout the year, and they are also spreading to new areas. As a consequence, many pets are left unprotected which also increases the risk to people. From a One Health perspective, local health services for humans might not be aware of new VBDs, especially in the beginning, so vets are a key layer of surveillance. You are critical in the protection of the community as a whole!

Prof. Jacques Guillot
Professor of Parasitology and Mycology at the Veterinary College of Nantes (Oniris) and member of the resarch group IRF at the University of Angers

"One Health has become more important in recent years, because we are facing some very serious problems. One is zoonoses. But we also need to consider resistance to anti-infective drugs. This problem can be managed using the One Health approach, by promoting more rational use of anti-infective products in both humans and animals.

KEY TAKEAWAYS

- Some of the **vector-borne diseases** that are gaining ground due to rising temperatures are also **important zoonoses**.
- A One Health approach is necessary to understand how **rising temperatures are impacting animal and human health**.
- One of the **key areas** where medical doctors and vets need to cooperate is in the **prevention of drug resistance**, which can be achieved by rational use but also implementing **preventive strategies such as vaccination and continuous parasite protection**.
- Multidisciplinary cooperation between vets, medical doctors, biologists, forest scientists and other professionals is **necessary to tackle the challenges of emerging diseases and rising temperatures**.
- **Vets are a key source of information for pet owners**, and can influence their behaviour and attitudes towards parasite-borne diseases and their prevention.

Prof. Jacques Guillot
Professor of Parasitology and Mycology at the Veterinary College of Nantes (Oniris) and member of the resarch group IRF at the University of Angers.

Parasites of zoonotic origin are quite diverse. There are parasites that are transmitted directly by contact, for example, from a dog or cat. There are also parasites that are picked up by the accidental ingestion of cysts present in the environment. I am thinking of toxocariasis for example, with a risk of infection in humans. Then there are the vector-borne zoonoses. For these vector-borne zoonoses, we should think first of all of leishmaniosis, we can also think of dirofilariosis and in France, the zoonotic dirofilariosis that poses a problem is *Dirofiaria repens*, much less than *Dirofilaria immitis*.

IMPORTANT PARASITIC ZOONOSES

Scabies can be transmitted to people by direct contact. Dogs and cats shed Toxocara spp. Eggs that pollute the environment and pose a zoonotic risk, especially to children and the immunocompromised individuals.

Regarding vector-borne diseases, there is no direct transmission from pet to people. However, pets can act as reservoirs for some dangerous zoonoses, such as leishmaniosis and dirofilariosis.

DISEASE	MAIN RESERVOIR	VECTOR	COMPANION ANIMAL HOST
Babesiosis	Wildlife (sylvatic), Dog (domestic)	Ticks	Dog
Dirofilariosis	Dog, Cat, Wildlife	Mosquitoes	Dog, Cat
Leishmaniosis	Dog, Wildlife	Sandflies	Dog
Rickettsiosis, Anaplasmosis and Ehrlichiosis	Dog, Wildlife	Ticks	Dog, Cat
Lyme disease (borreliosis)	Wildlife	Ticks	Dog
Bartonellosis	Cat	Flea	Dog, Cat
Toxocariasis	Dog, Cat	Non-vector disease, infection from the environment	Dog, Cat
Scabies	Dog, Cat	Non-vector disease, direst transmission from sick animal	Dog, Cat

ONE HEALTH IS A FAMILY MATTER

There are dozens of vector-borne diseases (VBDs). However, the following are the most impactful to animal health: the Big 5. Most importantly, you might face them soon, that is, if you haven't yet!

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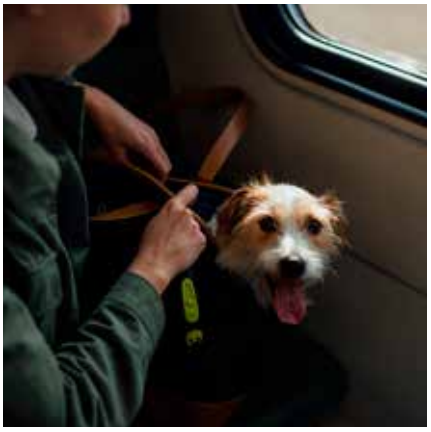
One Health initiatives should also focus on companion animals. We are more in contact with our pets than with livestock. They sleep with us. We let them lick our faces. We kiss them.

Dr. Paul Overgaauw
President of the European Scientific Council Companion Animal Parasites.



LEISHMANIOSIS

Leishmaniosis is gaining ground in Southern Europe and there are many imported cases to other countries.

Sandflies have invaded Italy. Consequently, autochthonous leishmaniosis cases have been detected in these areas.

As a consequence of pet travel and animal movement (such as rescues travelling to northern countries), **many cases of imported leishmaniosis have been documented throughout Europe.**

Leishmaniosis is a serious disease for both pets and humans. Even though there is no viable vector in most of Europe, millions of dogs are infected and constitute a massive reservoir.

According to the World Health Organization, the burden of **human leishmaniosis is underestimated in Europe** (Ejov & Dagne, 2014)[2].

Vector: Sandflies

Distribution: A tropical disease worldwide, it is endemic in Southern Europe.

Reservoir: Still confined to Southern Europe, even though cases have been imported to other European countries.

Pathogen: *Leishmania* spp. (Protozoan)

Vets need to be aware of the dangers of uncontrolled pet importation and exportation. Support of these practices by some vets means that the new owners are also likely to ignore the dangers of imported diseases such as leishmaniasis.

Prof. Dr. Ute Mackenstedt
Head of the parasitology department at the Faculty of Natural Sciences in Hoffenheim.

DIROFILARIOSIS

Dirofilariosis is gaining ground in Europe, and has become endemic in several areas.

Humans are accidental hosts of dirofilariae. Worm larvae rarely reach maturity in people. However, *D. immitis* larvae often migrate to the lungs, while *D. repens* larvae cause subcutaneous nodules and ocular inflammation. **Human dirofilariosis is increasing worldwide, as warmer temperatures allow dirofilariae to mature to the infective stage in mosquitoes.**

In Europe, there are five species of invasive *Aedes* mosquitoes that could serve as vectors. In addition, many resident mosquitoes have vector capabilities. **Unfortunately, dogs are one of the principal reservoirs for both *D. repens* and *D. immitis* (Genchi et al., 2011)**[1].

Due to rising temperatures, imported dirofilariosis cases, and the presence of viable vectors, **dirofilariosis is expected to become established in Central European countries like Austria,** where *D. repens* autochthonous cases have been detected and *D. immitis* is increasingly diagnosed.

Cats, dogs and people can acquire dirofilariosis, independently of their lifestyle, when they come in contact with infected mosquitoes.

Rising temperatures and extreme weather events create favourable conditions for mosquitoes to multiply. Imported dirofilariosis cases are worrisome, because there is already a viable vector in many non-endemic areas. If the warmer seasons become longer, it would allow for the nematode to reach the infective L3 stage in mosquitoes, **which could mean the establishment of dirofilariosis in previously free areas.**

Vector: Mosquitoes

Distribution: In Europe, *D. immitis* is mainly found in the south, whereas *D. repens* can be found in many northern countries

Reservoir: Dogs and wildlife

Pathogen: *Dirofilaria* spp. (nematodes)

Vector: Ticks

Distribution: Worldwide. Rickettsial diseases are spreading in Europe.

Reservoir: Increasing incidence in Central and Northern Europe, more data are needed in the south.

Pathogen: *Rickettsia* spp., *Anaplasma* spp., and *Ehrlichia* spp. (bacteria)

RICKETTSIAL DISEASES

Rickettsial infections can cause severe disease in people, and they are becoming more common as tick distribution expands.

There are several emerging human rickettsial diseases in Europe. Most prominent among these is the Mediterranean spotted fever, which can cause meningitis and death.

Rickettsia have either a sylvatic cycle (wildlife reservoirs) or a domestic cycle that is maintained in dog populations **through the brown dog tick (*Rhipicephalus sanguineus*).**

Dogs can bring infected ticks closer to their owners. For example, in some areas of Southern Europe, there is a correlation between the percentage of dogs with *Rickettsia conorii* antibodies and the incidence of Mediterranean Spotted Fever in humans (Rovery et al., 2008)[3].

Vector: Ticks

Distribution: Widespread across the temperate regions of North America, Asia and Europe.

Reservoir: Increasing incidence in Central and Northern Europe, more data are needed in Southern Europe.

Pathogen: *Borrelia burgdorferi* (spirochetal bacteria)

LYME DISEASE

Lyme disease is one of the most common zoonoses in Europe.

Characterised in humans by the appearance of a target-like rash, or erythema migrans, Lyme disease is an increasingly diagnosed zoonosis. **Lyme disease in humans is symptomatic to a higher degree than its canine counterpart.** Dogs are not a reservoir for *Borrelia burgdorferi*.

According to the World Health Organization, human borreliosis is the most common tick-borne disease in Europe, **and cases have increased steadily, surpasing 360,000 in two decades (WHO & ECDC, n.d.)**[4].

Due to rising temperatures and the increased activity and range of ticks, **Lyme disease cases —canine and human— can be expected to grow in Europe.**

Vector: Ticks

Distribution: Worldwide. However, different tick species can carry different *Babesia* spp.

Reservoir: Depends on the Babesia species as well as the tick's. Wildlife act as reservoir for the sylvatic cycle of babesiosis, dogs for its domestic one.

Pathogen: *Babesia* spp., such as: *B. canis*, *B. vogeli*, *B. gibsoni*, *B. rossi*, *B. microti*, and more.

BABESIOSIS

Babesia are protozoa that infect red blood cells. The disease is generally characterised by fever, anaemia, icterus and haemoglobinuria.

***Babesia* spp. are able to invade the ovaries of female ticks and be transmitted transovarially to the next generation of larvae.** Together with trans-stadial transmission, this feature enables ticks to function as a reservoir in addition to their vector role, enabling maintenance of *Babesia* spp. locally for several tick generations, even without a vertebrate reservoir host.

There are many different Babesia species, some which are pathogenic for dogs and other animals, some for humans, and some for both. Different tick species can carry different *Babesia* spp. *Dermacentor reticulatus*, which is spreading geographically in Europe, is the most important vector for *Babesia canis*, which can cause severe disease and death in dogs. *Rhipicephalus sanguineus*, the brown dog tick, can be a vector of even more Babesia species. **Because *R. sanguineus* can complete its cycle indoors, it can serve as a vector for babesiosis with the dog as a reservoir.** *Ixodes ricinus* can carry some *Babesia* spp. of importance for humans and livestock.

René Bødker
Member of Copenhagen University's veterinary vector-borne disease team and a respected media commentator

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Protection is not a private issue. Vets should always mention: by the way, it is not only about you and your pet, it is also about your neighbour's pet and your neighbour.

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