


Tropical diseases: THE PARASITES INVASION

By Heinz Hänel



The fine hairs of the sandfly act as sound-absorbers so that it can approach its host almost noiselessly.

As the climate here in Germany becomes warmer, parasites that transmit formerly exotic diseases are finding ever more favourable conditions. Leishmaniasis is on the verge of becoming established, and Italy saw a local outbreak of dengue fever for the first time in the summer of 2020.

Sandflies approach noiselessly at twilight and hop around a few times after landing. Then they use their strong mouth parts to pierce their victim's skin. Blood starts to flow. The sandfly injects saliva to prevent it from clotting and to widen the surrounding blood vessels. After sucking up its meal of blood and lymph, it moves on to feed from its next host or lay its eggs. Sandflies are not picky about their hosts: all land vertebrates from frogs to human beings are possible hosts for these parasites, which are a mere 2 to 4 mm long and often sandy-coloured.

The powerful itch that follows the bites is by no means the biggest problem that they cause: some types of sandfly are parasites that can also transmit other parasites, the single-celled *Leishmania* that attack the white blood cells of mammals and can – depending on the strain involved – cause skin and mucosal ulcers or extremely dangerous changes to the liver, spleen, and bone marrow. Not all infections result in symptoms, but symptoms may occur years after an initial infection.

Sandflies have already arrived in Hesse

Sandflies are an intermediate host for *Leishmania*. Around 100 of more than 1,000 known sandfly species around the world can transmit *Leishmania*, and the interaction between the single-celled parasites and the sandflies is elaborately choreographed to facilitate the infection of further hosts: the *Leishmania* reproduce in the sandfly gut and obstruct it. After making several vain attempts to suck up blood, the sandfly regurgitates blood and up to 100 *Leishmania* parasites into the open wound. The sandfly saliva helps the *Leishmania* not only by preventing clotting, but also by attracting white blood cells to the bite wound that can then be attacked by the tiny parasites.

Leishmaniasis is a tropical disease chiefly found in South and Central America. In Europe, it is known only from southern areas around the Mediterranean and the Black Sea. Fortunately, sandflies are exceptionally poor flyers: they can manage no more than 200 metres, and even that only in very calm conditions, which is good news. Unfortunately, the bad news is that sandflies have nevertheless arrived in Germany already: parasitologists at Goethe University and the Senckenberg Nature Research Society identified them in North Hesse as far back as 2014.

If sandflies migrate to Germany and are seen here more often, that would be a very problematic development even if the new arrivals were free of *Leishmania*, as they appear to have been thus far. We currently see around 20 leishmaniasis cases every year in Germany, and those infections have all been picked up outside the country by travellers. But *Leishmania* are already here

– circulating in the blood of »man's best friend«. It has been estimated that there are between 20,000 and 100,000 dogs in Germany that are infected with the parasites. Some of them – unprotected by a vaccine – picked up an infection during a holiday. Others have been smuggled in illegally by dealers or are former strays brought here from Southern Europe by animal protection agencies. The city of Vienna estimates that 200,000 puppies are imported illegally into German-speaking countries every year, bypassing veterinary inspections and the tax authorities, and that unscrupulous puppy dealers are reaping vast profits from the trade.

2020: A local dengue fever outbreak in Italy

Ever milder winters, the migration of sandflies to Central Europe, and dogs imported without health checks mean that it is only a matter of time until Germany and Central Europe start to see autochthonous cases of leishmaniasis.

And this new tropical disease will not be the only new arrival. Over the last 40 years, the Asian tiger mosquito (*Aedes albopictus*) has spread to Europe. It was probably accidentally introduced into Germany in freight transport from Italy. It is now found in parts of Bavaria, Baden-Württemberg, Thuringia and Hesse. It can potentially transmit more than 20 pathogens including yellow fever virus, West Nile virus and dengue virus.

A case from the summer of 2020 involving an Italian traveller shows how quickly local outbreaks of a tropical fever can develop. The woman had been infected by dengue viruses in Indonesia, but only displayed symptoms after her return to a small north

Italian town near Vicenza. Three weeks later, five of the seven members of her household also contracted dengue fever – the viruses were presumably transported by the tiger mosquitoes that are already widespread in northern Italy.

The local health authorities reacted immediately: intense pest control activities to combat mosquitoes were carried out over three days in a 200 m radius of the house and people who had run a fever anywhere in the province in the previous 30 days were tested for traces of dengue viruses. The police distributed information flyers door-to-door and donations of blood and organs in the entire province were screened for the virus. Only then could the all-clear be given: this time, the outbreak had not flared up into a major outbreak. The restrictions that were in force because of the ongoing COVID-19 pandemic possibly contributed to this outcome, along with the watchfulness of health authorities that have already been preparing for the invasion of tropical diseases with a surveillance regime designed to pick up on exotic fevers.



The author

Prof. Dr. Heinz Hänel, born in 1955, is responsible for antidiabetic drugs research and development at Sanofi-Aventis. He studied biology at Goethe University, wrote his Diplom thesis in Canberra, Australia, and gained his doctorate at the Bee Research Institute in Oberursel and in Kuala Lumpur, Malaysia. His habilitation thesis dealt with the penetration of mammalian cells by yeasts. He has been teaching at Goethe University since 1994 and he has held an honorary professorship in zoology at the Faculty of Biological Sciences since 2001. Professor Hänel also serves on the Board of Directors of the Friends and Sponsors of the University of Frankfurt and has chaired Goethe University's Alumni Council since 2008.

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» West Nile fever, hantavirus infections and leishmaniasis will soon become highly relevant diseases in Central Europe«



An interview with the scientist Sven Klimpel, a parasitology and infection biology expert

Markus Bernards: Professor Klimpel, your research is on infectious diseases spread by animals (vectors), typically ticks, mosquitoes, and small mammals like rodents or bats. And you predict that such infectious diseases will increase globally. Why?

Sven Klimpel: According to the current figures from the World Health Organization, about 20 per cent of the infectious diseases known today are vector-borne diseases (VBD). More than 50 per cent of the world's population live in areas where the risk of contracting vector-borne infectious diseases is extremely high. In Europe alone, more than 80,000 people contract such an infectious disease on average each year. The pathogens causing these diseases are not usually transmitted through direct or indirect contact with infected people, as is the case with other disease pathogens such as influenza viruses or SARS-CoV-2. Instead, the pathogens are transmitted and disseminated by other organisms, which we call vectors. Once vectors have picked up a pathogen, they often remain

infectious throughout their entire lifespan, but the pathogen does not make them sick and they can thus act as a reservoir for it. Bloodsucking insects like sandflies, blackflies and mosquitoes are the most important vectors globally and in our latitudes, closely followed by rodents, bats and fruit bats. Especially in times of global change, countless new pathogens and vectors are finding their way into new habitats. We are also increasingly discovering novel pathogens, although their arrival in industrialized countries is often delayed. Changes in climate and ecosystems, lifestyles, the environment and host-vector interactions can influence the distribution and behaviour of vectors and open up new habitats for many species. In the coming decades, we can expect many vector-borne diseases to become much more widespread – in our own latitudes and in other parts of the world.

Which vector-borne diseases do you expect to see here in Central Europe in the future?