Anticimex®
TO PREVENT AND PROTECT

Swedish rats – an increasingly major threat to public health?

A report based on a study in cooperation between Anticimex and Uppsala University.

Contents.

Summary.

In a study conducted 2014–2015, a research team at the Zoonosis Science Center, IMBIM, at Uppsala University examined rats that were present in our local vicinity, such as workplaces, cafés and homes.

The purpose of the study has been to identify bacteria, viruses and parasites that can infect humans, and which the millions of rats living in Swedish cities may be the carriers of.

For the first time since the 1930's, researchers have found rats that carry antibodies against the most serious form of *Leptospira*, a bacteria that can cause serious illness in humans such as meningitis and leptospirosis (often called Weil's disease or field fever). The fact that carriers of *Leptospira* are living among us is new and troubling knowledge. Currently, there is no commercial vaccine for protecting humans against the bacteria.

At the same time, statistics show that the number of rodents in our society are increasing – and that they are becoming increasingly resistant to rodenticides.

In order to reduce the risk of people being affected by serious diseases, it is important to increase the awareness of the rats ability to spread pathogens and to find effective methods to reduce the risk of infection.

Swedish brown rats found to be carriers of a serious pathogen.

Background to the study.

Statistics show that the number of rodents is increasing in Sweden.[1] At the same time, there is a lack of knowledge regarding which microorganisms our native rats are carrying that can cause illnesses in humans. As transport and traveling between countries increases so does the possibility of new, previously unknown diseases entering Sweden.

Therefore, since the spring of 2014 the Zoonosis Science Center, IMBIM, at Uppsala University, has been conducting a research project to identify which infectious microorganisms Swedish rats may transmit to humans. The interdisciplinary Zoonosis Science Center is led by professors Åke Lundkvist and Björn Olsen, and this research project is coordinated by researcher Tanja Strand.

How the study was conducted.

In this first part of the project, the research team decided to search for *Leptospira*, a bacteria found in 300 different variants. One of the variants – *Leptospira interrogans* serovar Icterohaemorrhagiae – is very dangerous for humans.

The study has been conducted in close cooperation between Anticimex and Uppsala University. Anticimex collected dead rats in Stockholm, Gothenburg and Malmö, which were in turn frozen and delivered to Uppsala University. The Zoonosis Science Center at Uppsala University has then taken responsibility for the analysis of the rats.

As part of the study, a total of 30 rats were analysed for antibodies against *Leptospira* using the recognised method MAT (Microscopic Agglutination test), which was conducted by the National Veterinary Institute in Sweden.

Results of the study.

13 percent of the analysed rats were tested positive for the most severe variant of the *Leptospira* bacteria.[2] The rats that were infected were those that were found in the vicinity of apartments, cafes and shopping centres.

Leptospira is not unique to Sweden. Reports from countries such as Ireland[3] and Germany[4] show that *Leptospira* is on the rise. In an extensive report from Danmark[5], 584 cases have been confirmed where people were infected by the *Leptospira* bacteria, of which 168 had the most serious variant. In a similar study from Portugal[6], 1 024 patients were found to be infected with *Leptospira*.

The fact that rats in our immediate vicinity are carriers of this disease is worrying and needs to be investigated further.

Tanja Strand, researcher at Zoonosis Science Center, IMBIM, Uppsala University

> ***We suspect that Leptospira is significantly more common than previously thought, and that Leptospirosis can be on the rise in Sweden.***
>
> *Tanja Strand, researcher at Zoonosis Science Center, IMBIM, Uppsala University*

May cause Weil's disease and field fever.

The *Leptospira* bacteria can cause leptospirosis disease, which according to the Swedish Communicable Diseases Act is one of the 60 notifiable diseases in Sweden. The symptoms often resemble the flu and may pass by itself. But it can also develop into Weil's disease, which has a mortality rate of five to ten percent.

A report from Denmark showed that 63 percent (74 people) of 118 patients contaminated by *Leptospira* developed Weil's disease, of which 7 percent (5 people) died as a result of the illness.[7]

Together with Anticimex, the research team at the Zoonosis Science Center will now expand their research, in order to include more rats from more cities and to search for other rat-borne infections than *Leptospira*. The goal is to continue exploring how large a threat native rats are to public health.

Photo of Leptospira interrogans *taken in a scanning electron microscope.*

Facts about the *Leptospira* bacteria.

- The bacteria is transmitted from animals (primarily rodents but also domestic animals) to humans.
- The bacteria is spread primarily by infected urine, water contaminated by the urine of infected rats or other infected animals, coming into contact with the skin. The bacteria can enter through small wounds or scratches, but also through mucous membranes, such as in the eye.
- The bacteria can lead to Leptospirosis, which is a notifiable disease in Sweden.
- Leptospirosis can vary from showing no symptoms to being life-threatening.
- Leptospirosis can develop into Weil's disease with symptoms such as high fever, chills, headaches and muscle aches. It can also affect the liver and the kidneys resulting in jaundice and sometimes bleeding.
- The mortality rate of Weil's disease is reported to be between five and ten percent.
- Leptospirosis can also cause field fever. Leptospirosis and field fever can be treated with antibiotics if detected in time.

Source: Folkhälsomyndigheten.se 2014-04-13. Photo: CDC / NCID / HIP / Janice Carr (PHIL # 1220).

More rats – an increased risk of infection.

Rats are a growing problem – both in Sweden and worldwide.

Rats are a growing problem in our society. Rats appear out of sewer pipes on the fifth floor of apartment buildings, they are seen scurrying around in parks and playgrounds and diners film them with mobile cameras in restaurants.

When rats access homes and workplaces, they can cause great damage. Gnawed fixtures, bad odours and chewed cables resulting in short circuits and fires are just a few examples of the problems rats can cause. Rats can also be the source of other problems, such as undermining the ground and roads, eating plantations and giving areas and properties a bad reputation.

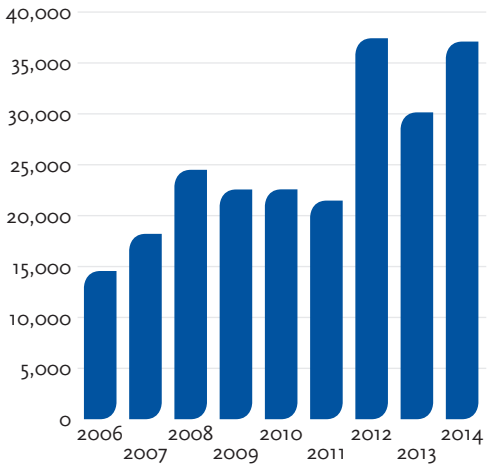
A report published by WHO in 2008 shows that rodent problems are not unique to Sweden. In the US, the cost of damage caused by rats is estimated to be about 114 billion SEK annually. In the UK, the annual cost of damage to infrastructure is estimated at around 0.7–2.5 billion SEK.[8]

We know that rats cause a lot of problems and large costs for both people and companies, but also society at large. The fact that they also carry serious infections is another challenge we now have to take on board.

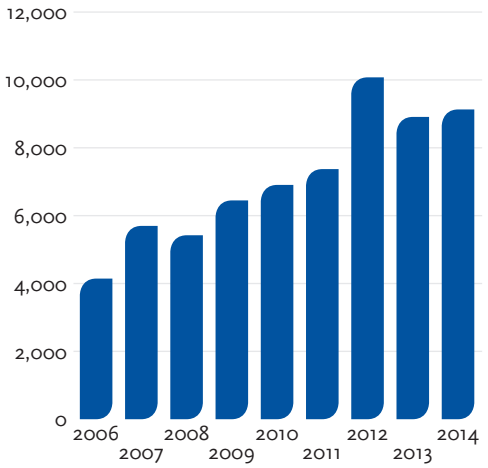
Thomas Persson Vinnersten, biologist at Anticimex

The number of rodent treatments is steadily increasing.

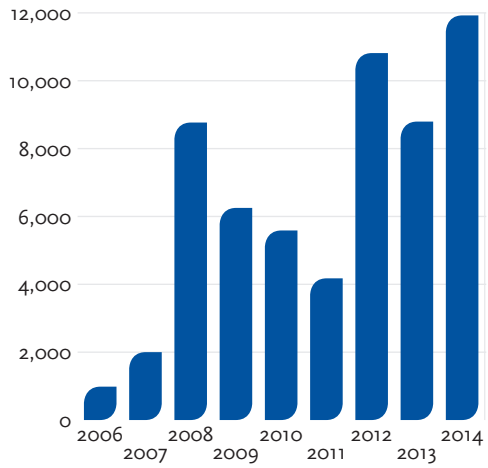
Each year, Anticimex carries out tens of thousands of treatments against rats and mice in Sweden. The latest statistics show that the number of treatments has almost doubled since 2006.



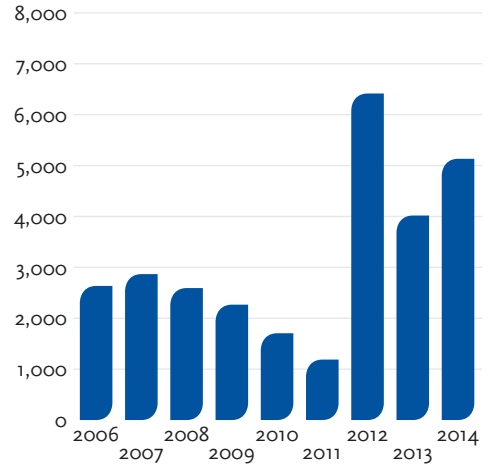
Sweden



Stockholm County



Skåne County



Västra Götaland County

Why do rats increase in number?

The prerequisites for a rats' survival are access to water, food and shelter.
Their increase is due to several factors, primarily:

- **Littering.**
  In areas where there is a deficiency in waste management and where composting takes place in leaking containers, rats often gather in greater numbers. The same can be said for places where it is popular to have a picnic or where people feed birds.
- **Climate change.**
  As our climate becomes milder the number of rats increase. Warmer winters without snow-covered grounds gives them access to food and water that has not frozen. As our summers get longer and warmer, people choose to eat outdoors, giving the rats more of an opportunity to find food. Rainy summers can increase water levels in the sewage systems, which can cause rats to move above ground instead.
- **Expansion of residential areas.**
  Building new residential areas is another important factor affecting rats. When rats are disturbed by the construction work, they are forced to seek out new places. At the same time, new residential areas often offer access to water, food and shelter.
- **Resistance to rodenticides.**
  There are studies showing that rats have developed a resistance to rodenticides. This resistance leads to even more difficulties controlling the rat population.

Increased risk of spreading infections.

Rats have always been present in our societies, spreading microorganisms that cause severe diseases. The most famous and serious illness is the Black Death, which during the medieval period killed, on average, every third person in Europe. Other examples of bacteria, viruses and parasites that are spread by rats and that cause illnesses are salmonella, toxoplasma and hantavirus. The increase in rat populations leads to increased health and safety risks for people.

Leptospirosis has a better prognosis if discovered early. Therefore it is important that we increase knowledge of* Leptospira, *and where it can be found in our society. This increases the possibility of patients receiving the correct diagnosis.

Tanja Strand,
researcher at Zoonosis Science Center, IMBIM, Uppsala University

Resistance to rodenticides among rodents.

In 2013, Anticimex conducted a resistance study of rodents, the first of its kind in Sweden. Eighty samples were analysed by a British laboratory and in five of the samples resistance was found, both in the brown rat and in the house mouse. The resistant rodents had been found in Uppsala, Växjö, Linköping and Kristianstad.[9]

Resistance to pesticides has major consequences for the community, and increases the need for preventive measures. Everyone – governments, municipalities and property owners, as well as businesses and individuals – must take responsibility for reducing the rats' rampage.

Thomas Persson Vinnersten, biologist at Anticimex

Studies outside Sweden also show that rats resistant to rodenticides are increasing. Denmark, the Netherlands, Scotland and England, for example, have followed the development of resistance for a long time. In England, rats with a genetic resistance to certain rodenticides were discovered shortly after these were introduced in the 1950's.[10] In some places in the south of England 70 percent of the rats are estimated to be resistant today. [11] A rat that has developed resistance may also pass it on to their offspring.

Facts about the brown rat (*Rattus norvegicus*).

- A rat pair can produce between 800 and 1,000 offspring each year.
- Rats can get through a hole of 2 cm (size of a two Euro coin).
- Rats can jump 60–80 cm.
- Rats can fall several meters without any injuries.
- Rats are skilled swimmers and can be submerged for up to 5 minutes.
- Rats can climb on the inside of vertical drainage pipes – up several floors of a building!
- Rats' teeth grow constantly, that's why they must continually gnaw them down.
- Rats can grow to a length of 20–30 cm, not including the tail. The tail can be approximately 15–23 cm long.

Source: www.anticimex.se

Increased knowledge and new methods are needed to reduce the risks of infection.

Since it is difficult to control the spread of infections that are caused by rats, it is important that greater efforts are made to reduce rodents in our environment. As the risk of resistance against rodenticides is becoming more widespread, the need for non-toxic control methods is increasing. In several areas, such as food production, the regulations concerning the use of chemicals and hazardous substances are also becoming stricter. Therefore, Anticimex is a driving force in efforts to transition over to an effective, long-term pest control without toxins.

The increase in rats, their resistance against rodenticides together with the new findings of pathogens make urgent demands for new, smarter and more efficient control methods.

Thomas Westman
service developer at Anticimex

Digital, non-toxic traps give good results.

The future of pest control will entail greater use of surveillance equipment and smarter, non-toxic traps. In recent years, Anticimex has started to develop new and non-toxic methods, which both prevent problems and, for example, replaces the use of bait stations.

The methods consist of digital traps, sensors and cameras that can be used both indoors, outdoors and in sewers. For example, today there is a trap that quickly and gently exterminates rats with an electric shock without the use of rodenticides. In the extensive sewage systems underground rodents have access to food and can quickly move between residential areas and industries. By using custom sewage traps the rat population underground can be reduced substantially – again, without the use of rodenticides.

Consideration for people and the environment.

The new methods have proven to offer effective and long-term protection. Thanks to wireless and continuous communication between devices, businesses and areas can be monitored and protected from rats around the clock. As the methods work without pesticides they are also safe to use in environments where humans and animals are present. They are also well suited to businesses that have high requirements relating to the use of chemicals and environmentally harmful substances.

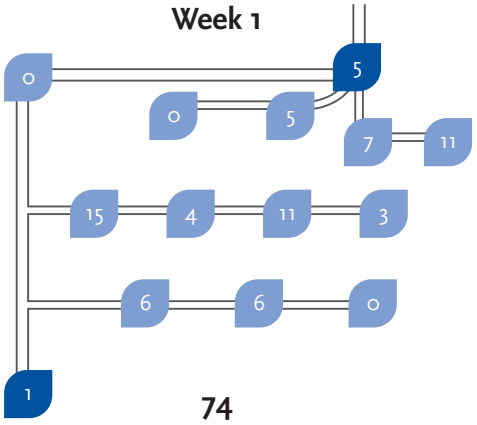
By digitising our pest control we can reduce the use of rodenticides. Thanks to continuous monitoring we can also confirm exactly where and when problems arise and we are therefore able to pinpoint our efforts.

Thomas Westman
service developer at Anticimex

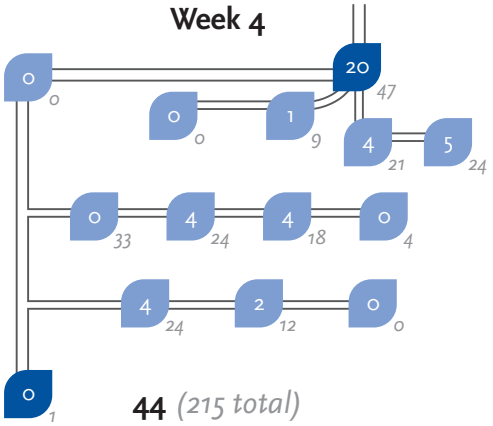
Successful treatment in sewage systems.

The following example shows the treatment of a comprehensive sewage system in Helsingborg, Sweden. Utilising effective sewage traps an initially large rat activity could be reduced to zero in 16 weeks. By methodically carrying out treatments against the rat population underground, positive effects are also achieved above ground.

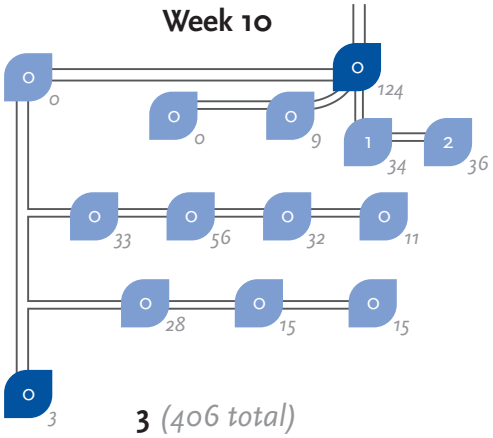
Firstly, the affected area was isolated with two drain traps installed at the outer edges of the sewage system, acting as gatekeepers (dark blue shapes). This meant that no new rats could enter the area. Sewage traps were then placed in drains and wells within the system, designed to take care of the rat population already within the defined area (light blue shapes). Since rats multiply rapidly, this is an important part of the process.



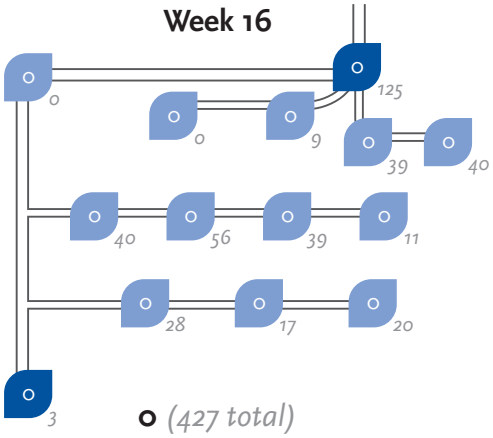
The figure shows statistics of hits for each sewage trap after 1 week, when a total of 74 rats were killed.



During the following three weeks another 141 rats were killed, i.e. a total of 215 since the beginning. The number in week 4 had then decreased to 44 rats, compared to 74 in week 1.



In week 10 three rats were killed, i.e. a total of 406 since the beginning.



After 16 weeks, with a total number of 427 rats killed, there was no registered rat activity at all. The sewage system was free of rats. After the treatment the sewage system was protected in a more cost effective way, using only two gatekeepers (the dark blue points).

Suggestions on preventing problems with rats.

Rats choose environments where food is available and there are places to hide.
By taking simple measures, both people and companies can reduce the risk of problems with rats. Some preventive measures Anticimex advises on are as follows:

- Seal cracks and crevices in a building's facade and foundation.
- In ground cavities and vents, install metal netting with a mesh width not exceeding 5 mm and wire thickness of at least 0.7 mm (stainless steel, copper or brass).
- Avoid having climbing plants against the facade (rats are good at climbing).
- Do not stack firewood, garden furniture or anything else that is stored away for the winter next to a facade because this provides shelter for rats.
- Make sure there are covers on rubbish bins and that any composting systems are maintained and located at a significant distance from a building.
- Clean away clutter under decks and low balconies as this can create protection for rats.
- If you have a brick house, you should check the air openings for discolouration which may be a sign of an entry hole.
- Check the ventilation pipes between the toilet and the attic. They may serve as an entrance for rats.
- Check that drain grates are attached and that there is water in the drains, which prevents rats from emerging out of the drainage.
- Place food, as well as candles and animal food, in boxes with lids. They can otherwise be food for rats.

We need to raise awareness among people. Unfortunately unawareness and bad habits contribute to rats thriving and reproducing in our immediate vicinity.

Thomas Persson Vinnersten, biologist at Anticimex

References

1. Statistik över saneringar 2006–2014. *Anticimex 2015.*

2. Highly pathogenic Leptospira found in urban brown rats (Rattus norvegicus) in the largest cities of Sweden.
Uppsala universitet 2015.

3. Leptospirosis in Ireland: annual incidence and exposures associated with infection.
Health Protection Surveillance Centre, HSE, Dublin, Ireland. National Virus Reference Laboratory, University College Dublin, Belfield, Dublin, Ireland 2013.

4. Leptospirosis in Germany, 1962–2003. *Robert Koch Institute, Berlin, Germany, Charité, Berlin, Germany 2005.*

5. Trends in Human Leptospirosis in Denmark, 1980 to 2012.
Department of Microbiology and Infection Control, Statens Serum Institut, Copenhagen, Denmark. European Programme for Public Health Microbiology (EUPHEM), European Centre for Disease Prevention and Control (ECDC), Stockholm, Sweden. Department of Medical Microbiology, Maastricht University Medical Center, Maastricht, the Netherlands. Department of Infectious Diseases Epidemiology, Statens Serum Institut, Copenhagen, Denmark. Department of Microbiological Diagnostics and Virology, Statens Serum Institut, Copenhagen, Denmark. Department of Health Analysis, Statens Serum Institut, Copenhagen, Denmar. European Programme for Intervention Epidemiology Training (EPIET), European Centre for Disease Prevention and Control (ECDC), Stockholm, Sweden 2015.

6. Human leptospirosis in Portugal: a retrospective study of eighteen years.
Unidade de Leptospirose e Borreliose de Lyme, Instituto de Higiene e Medicina Tropical, Universidade Nova de Lisboa, Lisboa, Portugal 2005.

7. Human Leptospirosis in Denmark 1970–1996: An Epidemiological and Clinical Study.
The Departments of Epidemiology and 2Gastrointestinal Infections, Statens Serum Institut, Copenhagen, Denmark 2002.

8. Public Health Significance of Urban Pests. *World Health Organization 2008.*

9. Resistensstudie på gnagare. *Anticimex 2013.*

10. Case of Apparent Resistance of Rattus norvegicus Berkenhout to Anticoagulant Poisons.
Department of Agriculture and Fisheries for Scotland, Rodent Control, East Craigs, Edinburgh, 12. Nature 188, 517 (5 November 1960).

11. https://www.hud.ac.uk/news/allstories/scienceversusthesuperrats.php. *2015-05-19.*

Anticimex is a market-leading international service company that creates safe, healthy indoor environments through inspections, prevention, treatments, guarantees and insurance. Founded in Sweden 1934, it currently operates in 14 countries and employs more than 3,600 people in pest control, hygiene and building environment services. Total revenues in 2014 amounted to approximately SEK 3.5 billion. Read more at www.anticimex.com

Anticimex®
TO PREVENT AND PROTECT

Text, design and production: www.luxlucid.com