

# SURVEILLANCE OF INFECTIOUS DISEASES IN ANIMALS AND HUMANS IN SWEDEN 2011

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**Editors:** Ulla Carlsson, Elina Lahti, Marianne Elvander.

Department of Disease Control and Epidemiology, National Veterinary Institute (SVA), SE-751 89 Uppsala, Sweden.

**Authors:** Björn Bengtsson, Mia Brytting, Ulla Carlsson, Erika Chenais, Helena Eriksson, Linda Ernholt, Gunilla Hallgren, Ingrid Hansson, Anders Hellström, Marika Hjertqvist, Cecilia Hultén, Carl Hård af Segerstad, Sofie Ivarsson, Desirée Jansson, Jerker Jonsson, Elina Lahti, Mats Lindblad, Margareta Löfdahl, Lennart Melin, Maria Nöremark, Anna Ohlson, Eva Olsson Engvall, Karin Persson Waller, Lars Plym Forshell, Therese Råsbäck, Christoffer Sjölund, Magnus Thelander, Susanne Thisted Lambert, Linda Trönnberg, Kerstin de Verdier, Helene Wahlström, Per Wallgren, Stefan Widgren, Erik Ågren, Estelle Ågren.

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**visiting address.** Ulls väg 2B **address.** 751 89 Uppsala **telephone.** +46 18-67 40 00  
**fax.** +46 18-30 91 62 **e-mail.** [sva@sva.se](mailto:sva@sva.se) **webb.** [www.sva.se](http://www.sva.se)

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# Introduction

The report describes surveillance concerning animal diseases and zoonotic agents in humans, food, feed and animals.

Sweden has for decades had a very favourable situation regarding serious animal diseases which has led to official freedom or additional guarantees for several diseases. In 2008 Sweden regained freedom from Porcine reproductive and respiratory syndrome, in 2010 from Bluetongue (serotype 8) and from Bovine tuberculosis in deer, from Paratuberculosis in 2011 and it is foreseen that freedom from Bovine virus diarrhoea will be achieved in the near future. All these diseases are more or less prevalent in the European Community.

The prevalence of *Salmonella* in food producing animals is, like in Finland and Norway, very low compared to most other countries. This is reflected by very few human cases of *Salmonella* caused by food produced in Sweden. *Echinococcus multilocularis* has for the first time been detected in Sweden. In 2011 the parasite was isolated at three different locations and is therefore considered endemic in the

country, although at a low prevalence. The regulation for travelling dogs regarding EM and rabies was changed beginning 2012 with a harmonization of the EU-legislation.

Trade of live animals constitutes the greatest risk for the introduction of new diseases. Further, vector-borne diseases seem to be increasing both in animals and in humans. The reservoir for these pathogens is in the wild animal population which makes surveillance and control challenging.

In order to improve existing surveillance activities a national strategy for prioritisation, maintenance and development of animal health surveillance will be developed during the coming years, a work that identifies short- and long term objectives and responsibilities with regard to animal health surveillance. In addition, strategy plans on certain zoonoses are being elaborated in co-operation with the Swedish Board of Agriculture, the National Food Agency, the Swedish Institute for Communicable Disease Control and the National Board of Health and Welfare.

# The livestock population and trade in live animals

Demographic data show that most farms are located in the southern and central parts of Sweden and animal husbandry is the major line of production. In the northern part of Sweden, farms are mainly small. During the last decades the number of holdings with livestock has decreased, whereas those remaining have increased in size. Most of the data below relates to the situation in June 2011. Maps 1-4 and Figure 1 give an overview of the livestock population in Sweden.

## CATTLE

There are 20,503 holdings with a total number of 1,511,846 cattle (including dairy and suckler cows, heifers, bulls, steers and calves younger than one year) in Sweden (Map 1).

The number of dairy cows has decreased over a long period of time. In June 2011 there were 346,500 cows in 5,260 dairy herds with an average of 66 cows per herd. The number of suckler cows was 195,650 in June 2011 with an average herd size of 16 cows.

In total, approximately 429,000 adult cattle and 27,000 calves were slaughtered during 2011, which is a slight increase compared to 2010.

## PIGS

The total number of pigs was 1,483,000 (Map 2) and the number of boars and sows was 153,000 in June 2011. The number of herds with breeding stock was 932. The sows farrow 2.2 times per year and artificial insemination is used in over 95% of the matings. The number of fattening pigs was 901,000 in 1,300 herds.

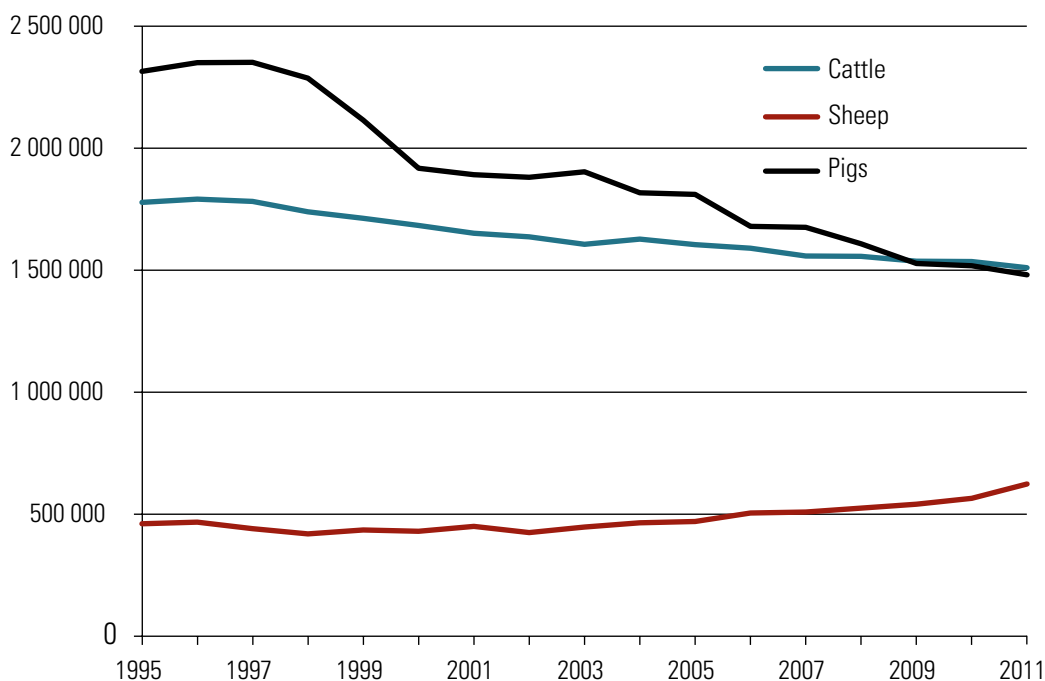
About 2,845,000 pigs were slaughtered during 2011. Of these approximately 53,000 were sows.

## SHEEP

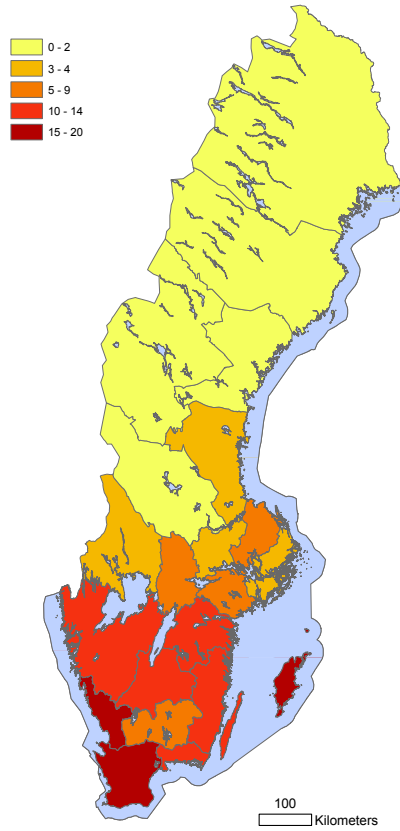
In June 2011, there were about 9,400 sheep holdings with a total of 297,700 ewes and rams and 326,000 lambs (Map 3). Sheep holdings in Sweden are usually small-scale enterprises but the size has increased in later years. The average number of adult sheep was 32 per holding.

During 2011 approximately 261,000 sheep were slaughtered of which 226,000 were lambs.

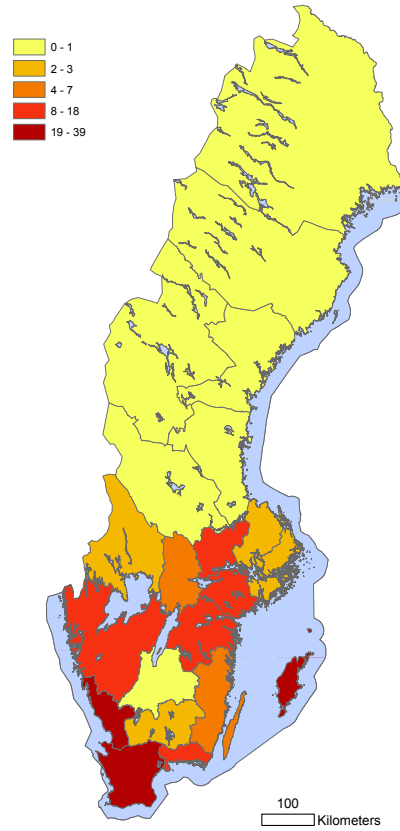
Figure 1. Number of livestock 1995-2011.



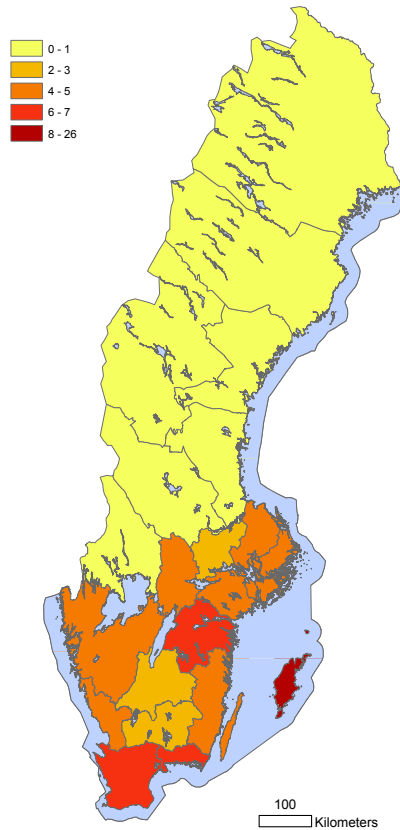
Map 1. Number of cattle per km<sup>2</sup> in 21 Swedish counties as of June 2011.



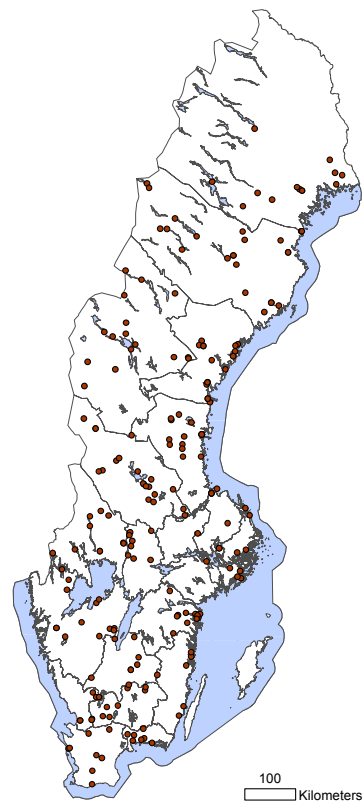
Map 2. Number of pigs per km<sup>2</sup> in 21 Swedish counties as of June 2011.



Map 3. Number of sheep per km<sup>2</sup> in 21 Swedish counties as of June 2011.



Map 4. Geographical distribution of fish farms, including places for caught of feral broddfish in Sweden 2011.





### GOATS

In 2011 the reported number of goats and goat holders in Sweden were 11,950 and 1,736, respectively. Most holders have only a few goats.

### POULTRY

The number of holdings in June 2011 with broiler production was 202. About 79.4 million chickens were sent for slaughter during the year.

There were approximately 6.4 million hens ( $\geq 20$  wks) in 3,800 holdings. The egg production was 115.8 million kilos during 2011 which is an increase compared to 2010.

According to the latest available statistics, approximately 100,000 to 130,000 turkeys were raised on 48 holdings in 2010.

The production of geese and ducks is very small. About 19,400 geese and only 310 ducks were slaughtered during 2011.

### FISH AND SHELLFISH

The health status for Swedish aqua culture is very good. The geographical location of Sweden as well as the climatic conditions are very favorable for fish and shellfish production. Sweden is, however, a small producer when compared internationally.

The Swedish fish farms are evenly distributed over the country with a slight predominance to the middle and southern parts (Map 4). Rainbow trout is the most frequently farmed fish followed by char, salmon and brown trout; salmon and brown trout mainly for restocking feral populations. Eels are imported from Severn in the UK through quarantine procedures for restocking of feral populations. A

minor part of the Swedish aqua culture is farming of pike-perch and perch. Of the shell fish production, blue mussel has the highest tonnage, while oysters and crayfish are more limited. The main tonnage of fish is produced in the continental zone, while of course the Swedish west coast is the area for production of blue mussels for consumption. Many of the Swedish farms are quite small compared to the ones in other parts of Europe, but there is a trend towards bigger units. A large proportion of Swedish aquaculture is owned by foreign companies, mainly Finnish.

The interest in production of blue-mussel for consumption has slightly stagnated during 2011, while interest still is high for the cultivation of improving environmental conditions. Swedish oysters are popular and in demand but the industry has difficulties to maintain a high production.

The health status in Swedish aquaculture is still high with few serious diseases and outbreaks.

### TRADE IN LIVE ANIMALS

In 2011, 233 pigs were brought into Sweden (from Norway), 20 cattle (from Denmark), 15 sheep and 25 goats (from Denmark) and 164 sheep from Finland (for slaughter).

The number of animals leaving the country during 2011 consisted of 271 cattle, 16,636 pigs of which 16,504 were sent for slaughter to Germany, 6 sheep were sent to Germany and 155 sheep to Lithuania.

Regarding the trade in poultry no figures are available.



# Animal databases

## *Animal databases*

### The Central Register of Holdings

The Swedish Board of Agriculture is responsible for the Central Register of Holdings. Each holding is allocated a unique identification number (holding number). The register contains information concerning the holding of bovine animals, pigs, sheep, goats, laying hens and poultry with details on holding number, visiting address, type of production, capacity and the geographical coordinates (for pigs, sheep and goats) of the holding as well as the name, address and telephone number of the keeper. Concerning the laying hens, all egg producers with a capacity of at least 350 laying hens and all those selling eggs for consumption shall be registered. The register contains specific information about production method, capacity and the number of houses and sections on the holding.

### The central Database of movement

The Swedish Board of Agriculture is responsible for the Central Database of movements. It contains data on all holdings with pigs, sheep and goats and their movements between holdings. The data encompasses address and the number of the holding as well as name and telephone number of the keeper. The database contains information from the keeper and slaughterhouses. Keepers may register movements in the database via the Internet, or in paper form. Animals are registered in groups in the database when moved. Concerning sheep and goats both the keeper who dispatches the animals, and the keeper who receives the animals, are responsible for reporting to the database, not later than seven days after the movement.

### The Central Database for Bovine animals

The Swedish Board of Agriculture is responsible for the Central Database for Bovine animals (CDB), to which all bovine births, deaths and movements shall be reported. The keeper is responsible for reporting of any changes within seven days of the occurrence. The purpose of the register is to allow swift and efficient tracing of a contagious disease, verification of the country of origin of a meat product, as well as control and administration of cross compliance. The system enables the scanning of animal disease forms into the data system.

### The Slaughter Register

The Slaughter Register (SLAKT) is administrated by the Swedish Board of Agriculture. The slaughterhouses are responsible for reporting all slaughtered animals including wild game. The producer's organization number or personal code number must be reported for all species except wild game. The holding number of the supplier is compulsory information for all species except horses and wild game. Reports shall be made every week.

### The database for dairy herds

The Swedish Dairy Association is responsible for the database for dairy herds (Ko-databas). The database includes milk recordings, fertility results and disease recordings for all animals at the dairy farm. It forms the bases for the development of different management tools used by the farmers, advisors and veterinarians. It is also a valuable tool for research concerning feeding, animal health, genetics etc. Approximately 90% of all dairy cows in Sweden are included in this recording program.

### Records at the Swedish Animal Health Service

The Swedish Animal Health Service is responsible for different control and monitoring programs. Relevant information about holdings with cattle, sheep, pigs and farmed deer that are affiliated to these programs is kept in computerised records.

### The animal health database

The animal health database (vet@) is used by the veterinary services for the documentation of the health situation on farms, including details about health status, treatment and vaccinations of individual animals. It is based on reports from practitioners to the Swedish Board of Agriculture. All veterinarians are obliged to continuously report activities of their veterinary practice on production animals. The purpose is to monitor the animal health situation in Sweden and use it as a base for preventive measures.

## REFERENCES

TRACES (TRAde Control and Expert System) is a trans-European network, developed by EU COM, for veterinary health which notifies, certifies and monitors imports, exports and trade in animals and animal products.

Yearbook of agriculture statistics, JO 20 SM 1102, Livestock in June 2011, and Animal products – Annual and Monthly Statistics, JO 48 SM 1202, Swedish Board of Agriculture.

# Institutions, organisations and laboratories involved in monitoring

## SWEDISH BOARD OF AGRICULTURE

The Swedish Board of Agriculture, SBA, is the Government's expert authority in the field of agricultural and food policy, and is responsible for agriculture and horticulture. This includes monitoring, analyzing and reporting to the Government on developments in these areas, and implementing policy decisions within its designated field of activities.

The SBA promotes animal health by strict animal welfare requirements and by combating and preventing the spread of contagious animal diseases and is also the chief authority for the Swedish district veterinarians.

## NATIONAL VETERINARY INSTITUTE

The Swedish National Veterinary Institute, SVA, is a Government expert authority within the field of risk assessments, prevention, diagnostics and the control of contagious and other serious infectious diseases including zoonotic agents.

Diagnostic capacity for the most feared contagious animal diseases is available at SVA. Antimicrobial resistance in bacteria from animals and from food of animal origin is monitored regularly and several control- and monitoring programs are being conducted in cooperation with stakeholder organisations and relevant authorities. Research and development are other important tasks for SVA.

## SWEDISH INSTITUTE FOR COMMUNICABLE DISEASE CONTROL

The Swedish Institute for Communicable Disease Control (SMI) is a governmental expert agency with the mission to monitor the epidemiological situation for infectious diseases in humans. Central to SMI operations is to, with the help of reports received, efficiently trace, analyze and combat infectious diseases. Preparedness is at a high level at SMI as concerns outbreaks of severe infectious diseases, both inside and outside the country's borders. SMI carries out diagnostic analyses of different bacteria, viruses, parasites and fungi, as well as water and environmental analyses. SMI's research and development is

closely connected to its other preventative measures, as well as to the current public health situation.

## NATIONAL FOOD AGENCY

The National Food Agency, NFA, is the central supervisory authority for matters relating to food, including drinking-water and has a direct responsibility to the Government.

The NFA has the task of protecting the interests of the consumer by working for safe food, fair practices in the food trade, and healthy eating habits. Fair practices in the food trade imply that the consumer can rely on the labelling as regards, for example, the composition, weight, keeping qualities and origin of the food. The NFA also performs risk assessments and chemical and microbiological analyses of food and water.

## COUNTY ADMINISTRATIVE BOARD

Sweden is divided into 21 counties, each of which has its own County Administration and County Governor. The County Administrative Board is a government authority that exists in close proximity to the people in each county. The County Administrative Board is an important link between the people and the municipal authorities on the one hand and the government, parliament and central authorities on the other. The County administrations have important coordinating functions regarding prevention, surveillance and eradication of contagious diseases.

## THE SWEDISH DAIRY ASSOCIATION

The Swedish Dairy Association is the national industry organization for Swedish dairy farmers and the Swedish dairy industry. The Swedish Dairy Association works on behalf of its owners, who are the seven largest dairy companies (jointly representing more than 99% of Swedish milk production), three livestock cooperatives, two semen-producing companies, and nine breeder societies. The Swedish Dairy Association gathers, develops and com-

municates knowledge relating to the entire chain from cow to consumer, including issues concerning animal health. The Swedish Dairy Association is further organizing the surveillance programs regarding bovine leucosis and infectious bovine rhinotracheitis. It is also organizing the eradication program for bovine virus diarrhoea virus and a control program for salmonellosis in bovines.

#### SWEDISH ANIMAL HEALTH SERVICE

The Swedish Animal Health Service AB (SvDhv) is a veterinary consulting company which business ideas originate from the 1960's. SvDhv is mainly engaged in animal health and animal welfare issues concerning the rearing of pigs, cattle (for meat production) and sheep. The goal is healthy animals for profitable farming and the customers are farmers, the industry and the government. The services provided by SvDhv are open to all farmers. SvDhv is owned by the main meat producing companies in Sweden and is officially responsible for general animal health programs for pigs, cattle and sheep. In addition, SvDhv is officially responsible for specific disease control programs, monitoring of resistance in pathogenic bacteria and the routine autopsy activity in farm animals. Research and development are also performed.

#### LUNDEN ANIMAL HEALTH ORGANISATION

Lunden Animal Health Organisation is a veterinary consulting company working with pig health welfare. The objective is to gather, develop and communicate knowledge associated with pig issues. The organization is a part of the national surveillance program for pig diseases and has permission to perform health control as well as providing a voluntary salmonella control program.

#### SWEDISH POULTRY MEAT ASSOCIATION

Swedish Poultry Meat Association (SPMA) represents 98% of the poultry meat production of chicken, turkey, goose and duck in Sweden, with members from the entire production-chain. The members are obliged to participate in the animal health programs, administered by SPMA such as control for Salmonella, Campylobacter, coccidiosis and clostridiosis.

Out of 79.4 million chickens produced during 2011, the members of SPMA produced 78.9 million. SPMA is multi functional; the major task is the work associated with economic and political indus-

try related matters important to its members. SPMA is receiving legislative referrals from the Swedish public authority and the EU's institutions. The organization also initiates and economically supports research.

#### THE SWEDISH EGG AND POULTRY ASSOCIATION

The Swedish Egg and Poultry Association is the national organization for Swedish egg producers, hatcheries, rearing pullet companies, egg packing stations and pullet feeding companies.

The Swedish Egg and Poultry Association is responsible for the organization of surveillance programs regarding animal health and welfare and the voluntary salmonella control program. The objective is to further support a sound egg production, with a high standard of animal welfare and food hygiene and safety on an economically competitive basis.

#### SWEDISH FISH HEALTH CONTROL PROGRAM

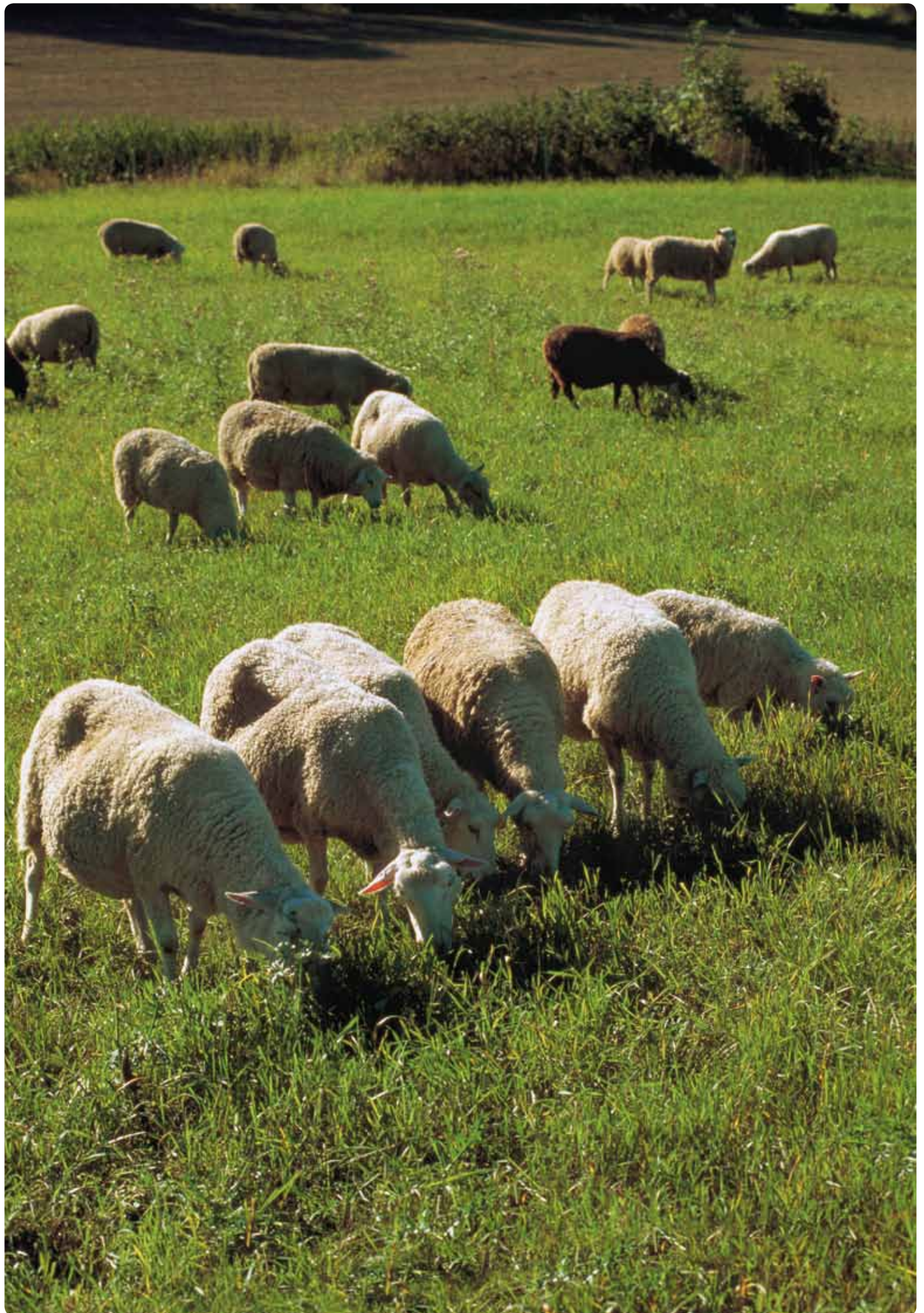
The main objectives of the Swedish Fish Health Control Program are to prevent the occurrence of and to stop the spread of serious and contagious fish diseases to fish farms and to wild populations of fishes. The services are open to all fish farmers. The Swedish Fish Health Control Program is owned by the main fish farming companies in Sweden and is officially responsible for general animal health programs for farmed fish and also farmed crayfish.

Important parts of the fish health control program are breeding program for good fish health, participation in control program for virus and bacterial infections as well as vaccination program. In addition, extensive information, advice and training services are offered to the associated fish farming companies.

Since 1990 the Swedish Fish Health Control Program has worked with a voluntary control program aimed at national control and eradication of renibacteriosis (BKD). The program has resulted in a decrease in the number of new BKD cases and the disease is now unusual in Swedish fish farms.

#### REFERENCES

<a href="http://www.jordbruksverket.se">www.jordbruksverket.se</a>	<a href="http://www.svdhv.se">www.svdhv.se</a>
<a href="http://www.sva.se">www.sva.se</a>	<a href="http://www.lundens.com">www.lundens.com</a>
<a href="http://www.smi.se">www.smi.se</a>	<a href="http://www.svenskfagel.se">www.svenskfagel.se</a>
<a href="http://www.slv.se">www.slv.se</a>	<a href="http://www.svenskaagg.se">www.svenskaagg.se</a>
<a href="http://www.lst.se">www.lst.se</a>	<a href="http://www.fiskhalsan.se">www.fiskhalsan.se</a>
<a href="http://www.svenskmjolk.se">www.svenskmjolk.se</a>	



# **Disease Surveillance 2011**

# African swine fever

## BACKGROUND

African swine fever (ASF) is an acute disease of domesticated pigs and wild boar. The acute clinical form of ASF can not, although caused by an unrelated virus, be distinguished from the clinical manifestation of CSF. ASF has its origin in sub-Saharan Africa where the virus persists in a sylvatic cycle including wild pigs and soft ticks. Outside Africa it is usually spread by the same routes as CSF, feeding pigs infected meat being the most important means of spread to new areas. Europe experienced a long-lasting outbreak of ASF in Spain and Portugal in the beginning of the late 1950s. This lasted until 1995 and one reminiscence of this outbreak is the continuous presence of the disease in Sardinia. In 2007, ASF was spread to Georgia and further to neighbouring countries in the Caucasus including Russia. The spread of ASF in this region and especially in Russia is ongoing and a great concern for neighbouring countries and the EU. ASF has never been diagnosed in Sweden.

## DISEASE

Infection with ASF virus give rise to acute, severe illness including high fever, inappetence, and severely impaired general condition. Dyspnea, discolouration of the skin, diarrhea and sometimes vomiting and haemorrhages are seen. Milder forms of the disease have been described.

## LEGISLATION

ASF is included in the Swedish Act of Epizootic diseases (SFS 1999:657 with amendments) and the control of the disease is regulated in detail through EU-directives.

## SURVEILLANCE

The purpose of the surveillance activities is to document freedom from ASF in the Swedish pig population and to contribute to the maintenance of this situation. The National Veterinary Institute (SVA) has been responsible for sample selection, sample analysis and reporting to the Swedish Board of Agriculture.

The serological analyses of ASF and analyses for ASF virus genome were performed at the National Veterinary Institute (SVA). ASF serology was done using a commercial kit (Ingezim PPA COMPAC

11.PPA.K.3) and in case of positive ELISA results a confirming western blot assay for detection of antibodies against ASFV was performed.

### Passive surveillance

As ASF is notifiable on clinical suspicion for both veterinarians and farmers, cases with suspect clinical signs will be investigated following notification to the Swedish Board of Agriculture. The following investigation is included: restrictions on the farm during investigation, sampling of sick or dead animals and examination of the herd for prevalence of clinical signs and production results. Due to the similarity of clinical signs, both diseases are investigated in suspicions of CSF or ASF. This regime is strongly recommended by the EU.

### Active surveillance

In 2011, sera for the active surveillance were collected by systematic random sampling from the surveillance carried out by the Swedish Animal Health Service for porcine respiratory and reproductive syndrome (PRRS).

## RESULTS

### Passive surveillance

Fifteen investigations following clinical suspicion of CSF/ASF were carried out during 2011. In the majority of these, reproductive failure was the main clinical manifestation. Following investigation including sampling the herds could be declared negative for CSF/ASF.

### Active surveillance

In total 2,262 samples were analyzed for antibodies to ASFV and all samples were negative regarding these antibodies.

## DISCUSSION

The results from the surveillance in Sweden regarding ASF during 2011 give additional documentation of freedom from this infection in the Swedish commercial pig population.

The present situation regarding ASF within and in close proximity of the EU emphasizes the need for both passive and active surveillance for ASF.

# Atrophic rhinitis

## BACKGROUND

Atrophic rhinitis (AR) is caused by toxin producing strains of *Pasteurella multocida* (PMT). Since PMT is a secondary invader not capable of penetrating an intact mucosa it is dependent on other infections. Traditionally *Bordetella bronchiseptica* has been considered the most important precursor for PMT, but also other bacteria and virus may precede PMT.

AR used to be a common disease in pig enterprises, but as improvements in rearing and disease preventing measures have been made the disease have gradually faded away. The Swedish Animal Health Service effectuates a control program since 1995.

## DISEASE

When PMT penetrate the nasal mucosa the nose mussels are destroyed and inhaled air will reach the respiratory organs without being sealed or warmed, which in turn increases the risk for other infections. Further, the bone building process is affected and the snout may become obliquely in young pigs. Affected pigs will also show a retarded growth.

## LEGISLATION

Atrophic rhinitis is a notifiable disease according to SJVFS 2002:16 (with amendments).

## SURVEILLANCE

The purpose of the control program is to declare herds selling breeding stock free from infections

with PMT, and thereby decrease the incidence of AR in all herd categories. Eradication of PMT is not realistic since it is an ubiquitous bacterium that can affect all mammals.

Nucleus and multiplying herds are controlled for presence of PMT at an annual basis. Anytime AR is suspected in a herd, it should be controlled for presence of PMT. If PMT is demonstrated, the health declaration is withdrawn and restrictions on sale of pigs are effectuated until the herd is sanitized and declared free from the disease. Diagnostic tools developed by DAKO (Copenhagen, Denmark) and evaluated at SVA during the late 80's and early 90's offered a possibility to combat AR in an effective way. Nasal swabs are cultivated on special media overnight. The entire microbial growth is harvested and diluted into water and the toxin of PMT is demonstrated by an ELISA system.

## RESULTS AND DISCUSSION

AR used to be a rather common disease, but due to efforts made in the early 90's and to the control program initiated in 1995 the disease is now very rare. The last Swedish herd was diagnosed with AR in 2005 (Table 1). In 2009, PMT was demonstrated in 10 out of 34 imported Norwegian boars in quarantine. These boars were isolated and found negative for PMT at resampling and thereafter installed at a boar station as intended.

Table 1. The total number of samples and the outcome of nasal swabs analyzed for PMT 2005-2011. The samples have been collected in all nucleus and multiplying herds, as well as in production herds suspected for AR.

Year	Samples	Positive samples	Diagnosed herds
2005	2413	29	2
2006	1836	2	0
2007	1878	1	0
2008	462	0	0
2009	1724	10	1
2010	1523	0	0
2011	1323	0	0

# Aujeszky's disease

## BACKGROUND

Aujeszky's disease (AD) virus is a herpes virus with capacity to infect several species but pig is the natural host. AD is an important disease in the swine production worldwide although many countries have controlled the disease, at least in the domestic swine population. Wild boars are reported to develop clinical signs of disease but their role as reservoirs or in transmitting the disease is debated. Other species that are infected, including cattle, sheep, goat, dog and cat, develop clinical signs but are not considered important for the transmission of the disease. A few

cases of human infection have been reported but AD is not considered a zoonotic disease.

Sweden has been officially free from AD since 1996 (Commission Decision 96/725/EU with amendments). This status was achieved following a national, government supported control program operated by the Swedish Animal Health Service that was introduced in 1991. Swedish Animal Health Service is also responsible for the ongoing active surveillance program and reports to the Swedish Board of Agriculture.





## DISEASE

The clinical manifestation of AD is different depending on the age of the infected animal. The most severe clinical signs develop in newborn or very young piglets in which infection leads to neurological signs and nearly 100% mortality, whereas adult pigs show only mild respiratory signs and inappetence. In addition to the mild clinical signs, pregnant sows can abort as a consequence of the infection.

## LEGISLATION

The disease is included in the Swedish Act of Epizootic Diseases (SFS 1999:657 with amendments) and thereby notifiable on clinical suspicion for all clinicians and farmers. Sweden has been granted certain additional guarantees by the European Commission regarding AD, to protect the Swedish swine health status.

## SURVEILLANCE

The purpose of the surveillance is to document continued freedom from the disease. Samples are analyzed for antibodies against AD virus using a blocking ELISA (Svanovir™, PRV-gB-Ab ELISA, Svanova) and in the case of clinical suspicion also for virus or virus genome. All analyses are performed at the National Veterinary Institute (SVA).

### Passive surveillance

As AD is notifiable on clinical suspicion for both veterinarians and farmers, cases with suspect clinical signs will be investigated following notification to the Swedish Board of Agriculture. The following investigation includes, in addition to restrictions on the farm during investigation, sampling of sick or dead animals and examination of the herd for prevalence of clinical signs and production results. Ongoing testing of animals for export and at breeding centers adds to the passive disease surveillance.

### Active surveillance

The active surveillance program comprises sampling of pigs at slaughter. The samples used for the surveillance originate from the PRRS surveillance program which comprises sampling of randomly selected production herds at slaughter. Three samples per herd are analyzed.

## RESULTS

### Passive surveillance

During 2011 six clinical suspicions of AD were investigated. The main clinical symptom in the majority of these herds was neurological signs in piglets. In most cases other diseases included in the Act of Epizootic Diseases were included in the investigation. Following investigation including sampling, all six herds were declared negative for AD.

Samples originating from pre-testing for export and at breeding centers were all negative regarding AD.

### Active surveillance

In 2011, 2,308 samples originating from approximately 770 herds sampled at slaughter were analyzed within the active surveillance program. All these samples were negative regarding antibodies to AD virus.

## DISCUSSION

The purpose of the surveillance is to document freedom from the disease and to contribute to the maintenance of this situation by detection of an introduction of the disease before it is widely spread in the swine population. The samples used for the AD surveillance come from the PRRS surveillance program. As the Swedish pig population has decreased during 2007-2011 and as the pig production in Sweden is changing considerably at present, an evaluation of the PRRS program will be performed during 2012 to, if necessary, adjust it to the new conditions. This will influence also the AD surveillance.

# Bluetongue

## BACKGROUND

Bluetongue is a vector borne disease of ruminants and camelids caused by any of 27 serotypes of bluetongue virus (BTV). The virus is transmitted by haematophagous midges (*Culicoides* spp).

Until 1998 bluetongue had not been detected in any European country but since then, outbreaks have been detected in several Mediterranean countries. In August 2006 BTV-8 appeared in the Netherlands. During 2006 and 2007 this outbreak spread to a large number of countries in northern and Western Europe. In 2008, further cases were reported and vaccination campaigns were launched in most of EU as soon as inactivated vaccines became available. In September 2008 the first case of BTV-8 infection in Sweden was confirmed. A vaccination campaign and intensive surveillance activities were initiated nationally, with focus on the southern part of the country. Following the detection of more infected animals over a larger area, the zones were adjusted accordingly. Vaccination and surveillance activities continued in 2009. In the first quarter of 2009 transplacental infection was detected in three newborn calves, all three cases originating from infections of their dams in autumn 2008.

In December 2010, Sweden was declared free from BTV-8.

## DISEASE

BTV causes clinical disease in ruminants, mainly in sheep. The different serotypes appear to vary in their ability to cause clinical signs in different animal species and also in the severity of clinical signs in the same species. The signs include fever, lesions in the mucous membranes of the mouth and nostrils, inflammation of the coronary band, swollen head and oedema in various body tissues.

## LEGISLATION

The control, monitoring, surveillance and restrictions on movements of certain animals of susceptible species are governed by Regulation 1266/2007 with amendments. Bluetongue is a notifiable disease and is included in the Swedish Act of Epizootic diseases (SFS 1999:657 with amendments).

## SURVEILLANCE

All diagnostic testing as outlined below was performed at the National Veterinary Institute (SVA). Serum samples were analyzed with a competitive ELISA (ID Screen® Bluetongue Competition ELISA) and milk samples were analyzed with an indirect ELISA (ID Screen® Bluetongue Milk). Organs and blood were analyzed with a real-time pan-PCR detecting 24 serotypes.

A positive case is defined as an animal giving rise to a positive PCR-product or an unvaccinated animal without remaining maternal antibodies giving a significant antibody titre.

### Passive surveillance

In addition to clinical surveillance, serological testing for Bluetongue prior to import and export, and at breeding centres was performed.

### Active surveillance

#### *Vector surveillance*

The vector surveillance initiated in 2007 in order to document the activity of relevant *Culicoides* spp. throughout the different seasons of the year, was continued until 2010 but not performed thereafter as Sweden was declared free from BTV-8.

#### *Targeted risk based monitoring*

294 animals from 147 herds geographically spread over the country in correspondence with the density of cattle holdings were selected for testing. The holdings were not randomly selected but the number of holdings to test was distributed among the state district veterinarians in accordance with the cattle density in each county. Two animals from each holding were selected for testing by the sampling veterinarian according to certain fixed inclusion criteria; older than six months, unvaccinated, having grazed (been exposed to the vector) the last season. The sampling took place after the vector season in November and December 2011 and samples were analyzed with the real-time pan-PCR routinely used. The number of tested herds was sufficient to detect 2% prevalence with 95% confidence. Map 5 shows the distribution of the tested herds.

## RESULTS

13 clinically suspect cases were investigated and tested during 2011, none was found positive. All other testing performed in 2011 was also negative.

## DISCUSSION

In summary, no clinical suspicions of bluetongue were confirmed nor was there any indication of viral circulation during 2011.

Competent vectors are present in Sweden and may spread the infection. Reintroduction of the virus to Sweden may occur by infected animals, infected vector or other yet unidentified means.

At present, there are no indications of BTV-8 circulation in neighboring countries and the EU situation appears favorable. However, as new serotypes emerge in the Mediterranean region or start circulating worldwide, this situation may rapidly change. Moreover, as national vaccination campaigns are now finalized in northern Europe and the prevalence of seropositive animals decline, the population will again become susceptible to BTV-8. Therefore, new introductions of this serotype, or any remaining foci in previously infected countries, could pose a threat. It is clear from the experiences of the past years that BTV may spread and take hold in livestock populations in Northern Europe.

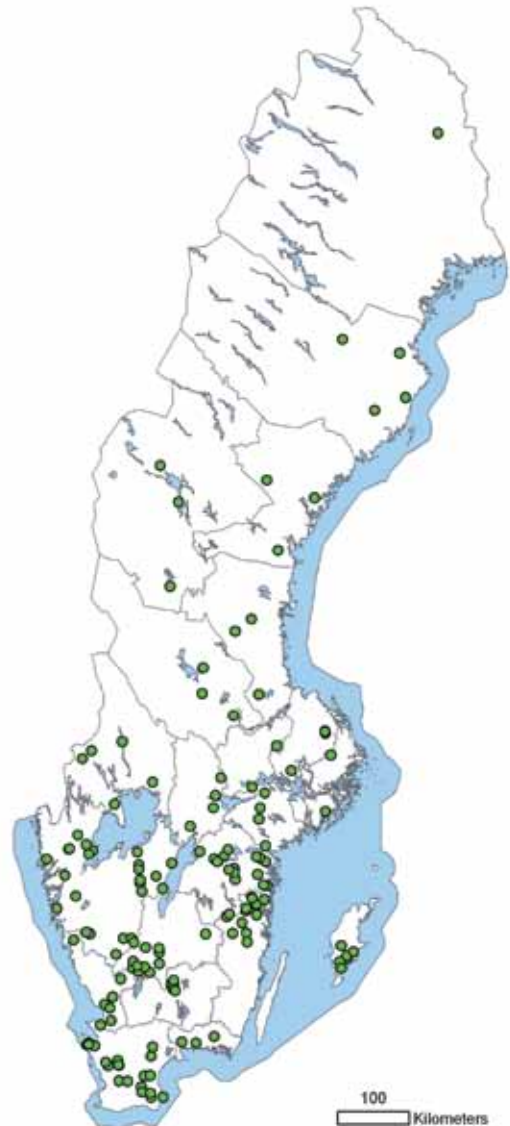
## REFERENCES

Ågren, E.C., Burgin, L., Sternberg Lewerin, S., Gloster, J., Elvander, M., 2010. Possible means of introduction of bluetongue virus serotype 8 (BTV-8) to Sweden in August 2008 - comparison of results from two models for atmospheric transport of the *Culicoides* vector. *Veterinary Record* 167:484-488.

Sternberg Lewerin, S., Hallgren, G., Mieziewska, K., Treiberg Berndtsson, L., Chirico, J., Elvander, M., 2010. Infection with bluetongue serotype 8 in Sweden 2008. *Veterinary Record* 167:165-170.

Nielsen S. A., Nielsen B. O., Chirico J., 2009. Monitoring of biting midges (Diptera: Ceratopogonidae: *Culicoides* Latreille) on farms in Sweden during the emergence of the 2008 epidemic of bluetongue. *Parasitology Research* 106:1197-1203.

Map 5. Geographical distribution of tested bovine herds in November and December 2011.



# Bovine spongiform Encephalopathy



## BACKGROUND

Classical Bovine Spongiform Encephalopathy (BSE) belongs to the group of diseases called Transmissible Spongiform Encephalopathies (TSE). BSE was first described in cattle in the UK in 1986. The current theory about causative agent is the prion-only hypothesis. This theory assumes that misfolded prions (small proteins) induce the same pathological structure in normal proteins in the body of the host, resulting in accumulation of prions and cellular damage without involvement of any microorganism. Classical BSE has primarily spread through contaminated meat and bone meal (MBM), i.e. MBM containing parts of animals infected with BSE. However, the primary source of the epidemic has not been established.

In 1996 the disease became a public health concern, after the detection of a new variant of Creutzfeldt Jacobs Disease in humans (vCJD), likely to be linked to classical BSE in cattle. This resulted in actions taken to prevent transmission to

humans through removal of Specified Risk Material (such as brain and spinal cord) at slaughter, restrictions related to feed to avoid recycling of infectious material to ruminants through infected MBM and when rapid test became available also an intensified surveillance.

In recent years, strains of BSE which show diagnostic dissimilarities with classical BSE have been described. The possible spontaneous occurrence of these cases is being discussed, as well as possible links to classical BSE and potential zoonotic aspects.

Sweden has historically had a low risk of introduction of classical BSE and a low risk of recirculation of the disease if it had been introduced. This has been assessed through the Geographical Bovine spongiform encephalopathy Risk (GBR) by the Scientific Steering Committee and by the European Food Safety Authority (EFSA), and later by the OIE Scientific Commission. Sweden is currently, through a resolution adopted by the OIE International Com-

mittee, recognized as having negligible BSE risk.

One case of BSE has been detected in cattle in Sweden. This was in 2006 in a beef cow born in 1994. This case was confirmed to be of H-type, i.e. not classical BSE.

#### DISEASE

The incubation period is long, from a couple up to several years. Symptoms are related to the neurological system and include altered behaviour and sensation as well as affected movement and posture. Clinical symptoms can last for weeks. The disease is progressive and always fatal.

#### LEGISLATION

Surveillance and control is regulated through the Regulation (EC) No 999/2001 of the European Parliament and of the Council of 22 May 2001, on national level the sampling is regulated by SJVFS 2010:9 saknr K19, amended through SJVFS 2011:29. BSE is a notifiable disease under the Swedish Act of Epizootic diseases (SFS 1999:657, with amendments) and there is a scheme to compensate farmers for losses due to eradication measures.

#### SURVEILLANCE

##### Feed

In order to survey compliance with the feed bans, samples are collected at feed-mills, of imported raw material for feed production and at farm level and analyzed for the presence of MBM using microscopy, Regulation (EC) 152/2009. The Swedish Board of Agriculture and the County Boards are responsible for this surveillance.

##### Animals

The Swedish Board of Agriculture is responsible for the surveillance program, which is carried out in cooperation with the National Veterinary Institute (SVA). SVA is appointed National Reference Laboratory, NRL (Regulation (EC) 999/2001). Samples from animals in passive surveillance and risk categories are analyzed at the SVA, and healthy slaughtered animals are examined at a private laboratory in Sweden.

##### Passive surveillance

All suspicions of BSE (bovine animals not responding to treatment, with clinical signs that are compatible with BSE symptoms) must be reported to the

authorities. The obligation to report applies for animal owners, veterinarians and everyone else who is responsible for the animals. Samples are analyzed with Bio-Rad TeSeE short assay protocol (SAP) in combination with Bio-Rad TeSeE Western Blot.

##### Active surveillance

The design is in accordance with Regulation (EC) No 999/2001 Annex III and Sweden applies derogation in accordance with Commission Decision 2008/908. During the year, the age limit for healthy slaughtered animals was amended.

The following categories were sampled in the active surveillance in 2011:

- All healthy slaughtered cattle over 48 months of age until June 30th, and from July 1st all healthy slaughtered cattle above 72 months of age.
- All healthy slaughtered cattle over 30 months of age if they origin in a country not included in the list in Commission Decision 2008/908.
- All emergency slaughtered cattle above 48 months of age, including slaughter used for feed to large carnivores.
- All fallen stock (animals dead or killed on farm but not slaughtered for human consumption) above 48 months of age. The animals are sampled at the rendering plants or at autopsy. Sweden applies derogation (Regulation (EC) 999/2001) for remote areas with a low cattle density, where no collection of dead animals is organised. The cattle population in these areas does not exceed 10% of the total bovine population in Sweden.

The samples from fallen stock, emergency slaughter, and some samples from normal slaughter at small slaughterhouses were examined with Bio-Rad TeSeE SAP. In case of positive or inconclusive results the material was prepared and examined by Bio-Rad TeSeE Western Blot.

The large majority of the samples from healthy slaughtered animals were examined with rapid tests at a private laboratory. The samples were tested with Bio-Rad TeSeE SAP. In case of positive or inconclusive results the material was prepared and examined by Bio-Rad TeSeE Western Blot at the SVA.

### RESULTS

#### Feed

In 2011, 105 feed samples were taken at feed-mills and 35 samples from imported raw materials were taken. Moreover, 204 samples were collected in the primary production at farm level. Out of these samples four samples at farm level were positive for fish meal. These were all investigated; one was found to be due to a mixing of samples at time of sampling (structure of feed was not consistent with feed claimed to be included in the sample), one was due to a faulty delivery from the feed mill and two were due to contaminated sampling equipment (all of the above information is from the Swedish Board of Agriculture).

#### Animals

##### *Passive surveillance*

In 2011 three cattle were examined due to clinical suspicion, all with negative results.

##### *Active surveillance*

In 2011, in total 83,103 samples were examined for BSE and all samples were negative. Of these, 11,598 were from fallen stock.

### DISCUSSION

No positive BSE cases were detected. Preventive measures have been in place for many years and the fact that no cases were detected support that these measures have been effective. The low number of clinical suspicions may be an indication of a lower degree of awareness among farmers and veterinarians compared to 5-10 years ago.

Reports of prion transmission studies including several passages in different species have shown that prion strains do not always remain stable through these passages. The source of the large epidemic of classical BSE has not been determined and atypical cases cannot be excluded as the source. Thus, the atypical cases may be a potential source of a new

epidemic. As the number of cases of classical BSE is decreasing within the European Union, surveillance is decreasing and moreover suggestions are put forward on EU-level for allowing the use of MBM in feed. If the bans are to be relaxed it is of importance to remember that unintentional cross-contamination at feed mills was sufficient to keep the epidemic going and this was the reason for the total feed ban in 2001. Relaxations of the total feed ban could potentially result in a new epidemic. Strict separation and sufficient bans must be kept in place to avoid any possibility of recirculation of BSE if it would enter the system again. Moreover, resources and focus must be relocated to survey the feed chain to enable early detection of cross contamination.

### REFERENCES

Gavier-Widén D, Nöremark M, Langeveld JP, Stack M, Biacabe AG, Vulin J, Chaplin M, Richt JA, Jacobs J, Acín C, Monleón E, Renström L, Klingeborn B, Baron TG. Bovine spongiform encephalopathy in Sweden: an H-type variant., *J Vet Diagn Invest.* 2008 Jan;20(1):2-10.

Capobianco R et al. (2007) *PLoS Pathog.* Conversion of the BASE prion strain into the BSE strain: the origin of BSE? Mar;3(3):e31.

EFSA Scientific Report on the Assessment of the Geographical BSE-Risk (GBR) of Sweden. Adopted July 2004 (Question No EFSAQ-2003-083). Last updated 8 September 2004. Publication Date 20 August 2004

[http://www.efsa.europa.eu/en/science/tse\\_assessments/gbr\\_assessments/572.html](http://www.efsa.europa.eu/en/science/tse_assessments/gbr_assessments/572.html)

# Bovine viral diarrhoea

## BACKGROUND

Bovine viral diarrhoea (BVD) is caused by bovine viral diarrhoea virus (BVDV), which is classified in the genus Pestivirus in the family *Flaviviridae*. Cattle are the primary host of BVDV, but most even-toed ungulates are probably susceptible to the disease. Cattle that are persistently infected serve as a natural reservoir for virus. The virus may be spread between animals via direct or indirect routes.

A voluntary surveillance and control program with the objective to eradicate BVD without vaccination was launched by the Swedish Dairy Association in 1993. The government and the farmers share the costs for sampling and testing. Since June 1, 2001, there is also a compulsory control program requiring all cattle herds to be tested for BVDV on a regular basis.

## DISEASE

BVDV may induce disease of varying severity, duration and symptoms after an incubation period of 6-12 days. Fever, depression, respiratory symptoms and diarrhoea are typical signs of acute BVD. In pregnant cattle, infection may result in reproductive failure such as abortion and stillbirth or the birth of calves that may be persistently infected with the virus. A more uncommon form of BVD is mucosal disease that may occur in acute or chronic form in persistently infected animals.

### Legislation

BVD is a notifiable disease (SJVFS 2002:16 with amendments). The voluntary control is regulated in SJVFS 1993:42 and the compulsory in SJVFS 2002:31.

## SURVEILLANCE

A risk-based surveillance scheme was introduced in January 2010 when the country was divided in regions depending on their BVD-status. In free regions sampling is mainly directed towards herds

buying or selling live animals. In regions not free from BVD all herds are sampled annually. Surveillance of dairy herds is performed by sampling bulk tank milk while surveillance of beef herds is performed by sampling at slaughter. In the latter herds live animals can also be sampled. Herds that are infected are screened and persistently infected virus carriers are identified and removed. Another important parts of the program are creating a positive attitude to biosecurity in the farming community and protecting the free herds from introducing BVDV.

Diagnostic testing is performed at the National Veterinary Institute (SVA), Uppsala, Sweden. For screening, an indirect antibody ELISA (Svanovir® BVDV-Ab ELISA) for serum, milk and bulk milk samples is used.

## RESULTS

In 2011, the total number of herds affiliated to the voluntary program was 16 848 and at the end of the year 16 834 herds were certified as free from the disease. Of the remaining herds, four are considered infected. The other herds only have to be tested further before becoming certified free from the disease. In 2011, one herd was discovered newly infected.

## DISCUSSION

All herds in Sweden were affiliated to the voluntary or compulsory programs during 2011. At the end of 2011, 99.9% of the herds were certified BVD-free and 0.1% or less was infected by BVD-virus. The control program has been successful, and the goal is to eradicate the disease during 2013.

## REFERENCES

Swedish Dairy Association, Statistics for 2011.

# Brucellosis

## BACKGROUND

Brucellosis is caused by zoonotic, gram-negative bacteria belonging to the genus *Brucella*. Most human cases are caused by four species, each having a preferred animal host. *Brucella melitensis* occurs mainly in sheep and goats, *B. suis* in pigs, *B. abortus* in cattle and *B. canis* in dogs. The infection is transmitted by contact with the placenta, foetus, foetal fluids and vaginal discharges from infected animals and may also be found in milk, urine, semen and feces. *In utero* infections occur, however venereal transmission seems to be uncommon. Humans are usually infected through contact with infected animals or contaminated animal products such as cheese made of unpasteurized milk.

Brucellosis was eradicated from the Swedish cattle population during the first half of the last century. The last Swedish bovine case was recorded in 1957. Brucellosis in humans has been a notifiable disease in Sweden since 2004. No more than 10 annual cases have been reported. All patients have acquired the infection outside Sweden.

## DISEASE

### Animals

In animals brucellosis mainly causes reproductive disorders such as abortions, orchitis and epididymitis. Arthritis is occasionally seen in both sexes. Systemic signs and deaths are rare, except in the foetus or newborn. The period between infection and abortion or other reproductive signs is variable. Infected asymptomatic females may shed the organism in milk and uterine discharges.

### Humans

*B. melitensis* is considered to be the most severe human pathogen in the genus. Brucellosis in humans can be asymptomatic, but the course of the illness is extremely variable and the clinical signs may appear insidiously or abruptly. Typically, brucellosis begins as an acute febrile illness with nonspecific flu-like signs such as fever, headache, malaise, back pain, myalgia and generalized aches. Some patients recover spontaneously, while others develop persistent symptoms that typically wax and wane. Genitourinary involvement is noticed in 2-20% of the human cases. The mortality rate is low, around 2%.

## LEGISLATION

### Animals

Brucellosis in food-producing animals is included in the Swedish Act of Epizootic diseases (SFS 1999:657 with amendments). Vaccination is prohibited and notification of suspect cases is mandatory. Sweden's bovine brucellosis free status is officially stated in EU legislation since 1994, Decision 2003/467/EC last amended by Decision 2005/764/EC. Ovine brucellosis is encompassed by Directive 91/68/EEC, Sweden was declared officially free of brucellosis in sheep and goats in 1995 (Decision 94/972/EC).

Current surveillance standards for bovine and ovine brucellosis are given in the EU legislation, Directive 64/432/EEC and Directive 91/68/EEC, respectively.

### Humans

Brucellosis has been a notifiable disease since 2004 according to the Communicable Disease Act (SFS 2004:168).

## SURVEILLANCE

### Animals

All diagnostic testing as outlined below is performed at the National Veterinary Institute (SVA). Serum samples are tested with the Rose Bengal Test, and in case of positive reactions, confirmed with the Complement Fixation Test. A positive case is defined as an animal from which *Brucella* spp. has been isolated, or an animal with a confirmed positive serological reaction.

### Passive surveillance

Suspicion based on clinical signs in food producing animals must be reported to the Swedish Board of Agriculture and subsequently investigated.

In addition to the passive surveillance, serological testing for brucellosis is performed prior to import and export of all susceptible species, and in bulls and boars at semen collection centres.

### Active surveillance

Screening for *B. abortus* has been conducted regularly in Sweden since 1988, for *B. melitensis* since 1995 and for *B. suis* since 1996. The purpose of the surveillance is to document freedom from bovine



and ovine brucellosis in Sweden in accordance with the EU legislation and to further document freedom from the disease in the Swedish pig population. The Swedish Board of Agriculture finances the surveillance, which is planned and executed by the National Veterinary Institute (SVA). Since the start of the screenings, no samples have been confirmed positive.

In addition to the screenings described per species below, yearly surveillance is performed by post mortem examination and culture of aborted fetuses. In 2011, 44 ovine, 3 caprine, 21 bovine, 2 visent and 51 porcine fetuses were examined by culture.

#### Surveillance for brucellosis in cattle

From 1997 and onwards, approximately 3,000 samples (bulk milk and/or serum samples) have been tested each year for antibodies against *B. abortus*. Samples have been collected within the surveillance programs for bovine virus diarrhoea and enzootic bovine leucosis and obtained from those samples by convenience sampling (in other words not strictly random), evenly distributed throughout the sampling period. This sampling was not performed in 2011 and will onwards be conducted every third year.

#### Surveillance for brucellosis in sheep and goats

Since 1995 approximately 10,000 samples have been tested each year, representing approximately 5% of the sheep population. During 2011, 7,141 serum samples from 764 individual holdings were analyzed for *B. melitensis*. The serum samples were collected within the surveillance program for Maedi/Visna. In addition 301 serum samples from goats were analyzed, those samples were collected within the Caprine Arthritis Encephalitis program. The samples were obtained from those samples by convenience sampling (in other words not strictly random). The diagnostic test used was the Rose Bengal Test (RBT), with the complement fixation test for confirmation.

#### Surveillance for brucellosis in pigs

From 1996 and onwards, approximately 3,000 serum samples from pigs have been tested for antibodies against *B. suis* each year. In 2011 1,965 samples were tested. The serum samples were collected within the surveillance program for PRRS, all samples collected for that program were also analyzed



for *B. suis*. The diagnostic test used was the Rose Bengal Test (RBT), with the complement fixation test for confirmation.

#### Humans

The surveillance in humans is passive. Diagnosis of human cases is made by detection of *Brucella* species in blood, bone marrow or urine or by detection of antibodies in blood. The bacteria are isolated by culture of clinical samples, and identified by real-time PCR of colonies.

### RESULTS

#### Animals

During 2011 clinically suspect cases were reported from two bovine herds. Serum samples were taken from affected individuals, all samples were negative. No clinical suspicion was seen in any other animal species. Additionally, one surveillance sample from a breeding centre was positive; the animal was re-sampled with negative result and infection ruled out.

Surveillance samples from three animals in one sheep herd were positive. There were no clinical signs in the herd nor any epidemiological links suggesting possible routes of introduction and after further testing *Yersinia enterocolitica* serotype O:9 was identified as causing the false positive reactions.

All other samples, serological and bacteriological, from active as well as passive surveillance were negative.

#### Humans

For years, no domestic cases have been reported and Sweden is considered free from brucellosis. In 2011, one asymptomatic domestic case was reported, not actually infected in Sweden. This was a child born in Sweden by a mother infected in Syria during her pregnancy. *Brucella* was isolated in blood from both mother and child.

In 2011, 11 cases were reported, 8 men and 3 women. Except for the case reported as domestic the country of infection was Iraq for 7 cases, Syria and India for 1 case respectively and for 1 case country of infection was unknown.

### DISCUSSION

In summary, no herd or any individual animal was diagnosed with *Brucella* infection during 2011. The long standing and rather extensive serological screenings performed without finding any infection and the very low number of human cases, with no domestically acquired, confirms that brucellosis is not present in Swedish food-producing animals.

The active surveillance in aborted fetuses from food-producing animals is an important part of the surveillance system.

Imported dogs or dogs mated abroad might harbour *Brucella canis*. During 2011 an imported American Staffordshire terrier bitch mated in Serbia and after that in Poland tested positive for *Brucella canis* with bacterial culture and serology. An epidemiological investigation and contact tracing including the contact dogs of the bitch and the Serbian male (at the time residing in Sweden) was performed revealing no more infected dogs. The contact dogs of the Serbian male were tested but not the contacts of the Polish one. The bitch was euthanized and all contact dogs were kept isolated until repeated serological and bacteriological tests were performed and the dogs thus confirmed negative. No human cases were notified.

# Campylobacteriosis

## BACKGROUND

Thermophilic *Campylobacter* spp. are gram negative curved rods, and are the most common causes of human bacterial gastroenteritis in many countries. *Campylobacter* was for the first time isolated from human diarrhoea in 1972 although spiral bacteria had been seen microscopically in human stool samples in earlier decades. Most human infections are caused by *C. jejuni*, followed by *C. coli* and a few by other *Campylobacter* species.

Birds are considered the principal reservoir although *Campylobacter* can colonise the intestinal tract of many other animal species. The bacteria are excreted in faeces. *Campylobacter* spp. are fragile organisms but are able to survive in water for longer periods. The infectious dose in human infection is low. A seasonal peak in the summer months is observed in most European countries. Most human infections are sporadic, which makes identifying the source of infection difficult. Risk factors for infection include consumption of or handling undercooked contaminated meat products (especially poultry), consuming contaminated unpasteurized milk and other dairy products, drinking water from

contaminated supplies, travelling abroad and contact with farm animals and pets.

The incidence of human campylobacteriosis (per 100,000) has varied between 66.6 and 96.4 (Figure 2). Of these, approximately 20-40% have been reported as domestic.

## DISEASE

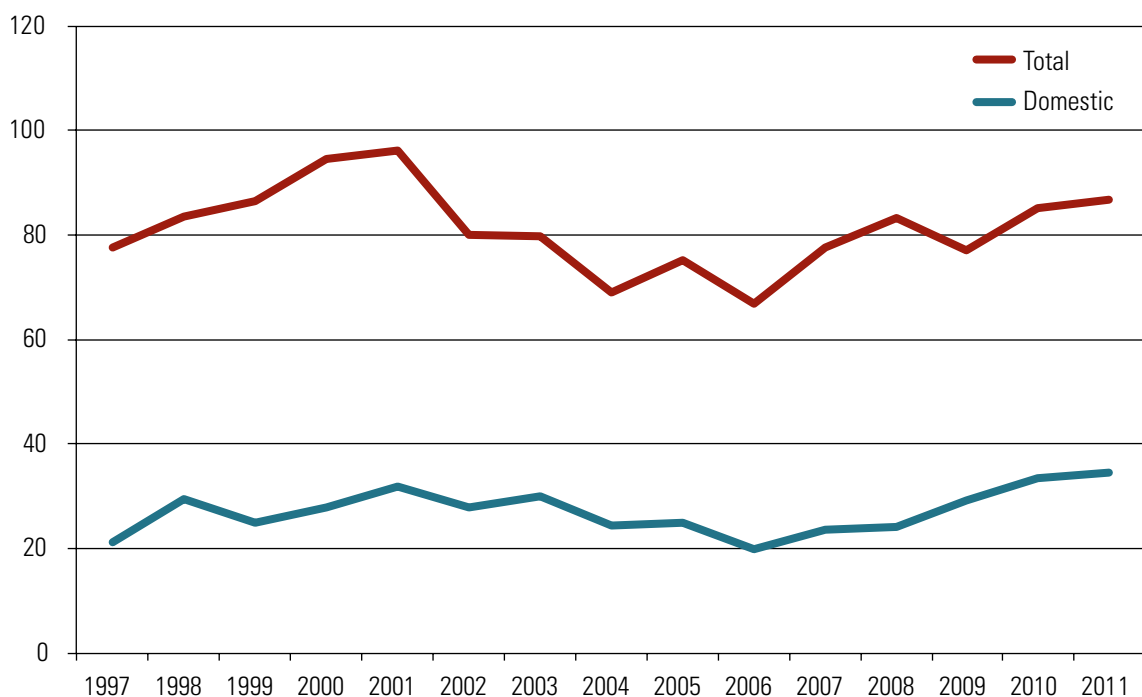
### Animals

Asymptomatic carriers of thermophilic *Campylobacter* are common in several animal species.

### Humans

Campylobacteriosis is an acute usually self-limiting enteric disease that resolves within a week. In some individuals, the symptoms may last longer. The symptoms are mild to severe: diarrhoea, fever, abdominal pain, nausea and malaise. The infection can be complicated by reactive arthritis, irritable bowel syndrome and a neurological disorder, Guillain-Barré syndrome.

Figure 2. Notified incidence (per 100,000) of human campylobacteriosis in Sweden 1997-2011.



### LEGISLATION

#### Animals

Thermophilic *Campylobacter* spp are not notifiable in animals. Currently, only *Campylobacter fetus* sp. *venerealis*, which causes bovine genital campylobacteriosis, is notifiable in Sweden.

#### Food

Detection of *Campylobacter* spp. in food is not notifiable.

#### Humans

Infection with *Campylobacter* is notifiable according to the Communicable Disease Act (SFS 2004:168).

### SURVEILLANCE

#### Animals

A surveillance program for broilers has been operated by the industry (Swedish Poultry Meat Association) since 1991. Since 2006, sampling is performed by collecting intact caeca from 10 birds from every slaughter flock at the major slaughterhouses. The caeca are pooled into one composite sample per batch. The program covers 99% of broilers slaughtered in Sweden. Samples are analyzed according to ISO 10272 part 1 and 2.

In 2011, a survey was performed on broilers slaughtered at small scale abattoirs.

#### Food

Monitoring is based on in-house control in the companies and on sampling by the local authorities. Sampling by the authorities can for example be performed as part of a project or as a follow up of complaint or outbreak investigation. No major projects were done in 2011. Results from some earlier major projects can be found at [www.slv.se](http://www.slv.se).

A study was performed on *Campylobacter* in imported broiler meat at retail level.

#### Humans

There is no active surveillance in humans.

### RESULTS

#### Animals

In 2011, thermophilic *Campylobacter* spp. were detected in 357 (12.8%) of the 2,788 flocks at slaughter in the national *Campylobacter* program (Figure 3). However, prevalence in small scale flocks was clearly higher: 86 (60.1%) of 143 flocks were positive for *Campylobacter*. In 55 (38.4%) samples

the levels of *Campylobacter* were between 100 and 1000 cfu/gram. As in previous years, a seasonal variation of *Campylobacter* in broilers was observed with the lowest value in the winter and highest in the summertime.

#### Humans

In 2011, 8,214 cases of campylobacteriosis were notified. A majority of the reported cases are infected outside Sweden. Of the reported cases, 39.9% (3,275) were domestic. The incidence in domestic cases (33.7/100,000 inhabitants) only increased with 1% compared to the year before. No significant trend in domestic cases in 1997 to 2011 has been demonstrated (negative binomial regression analysis). The number of notified cases of campylobacteriosis increases during summer, especially in August. However, in 2011, the summer peak of domestic cases was higher than any of the previous summer peaks during 2006-2010.

#### Food

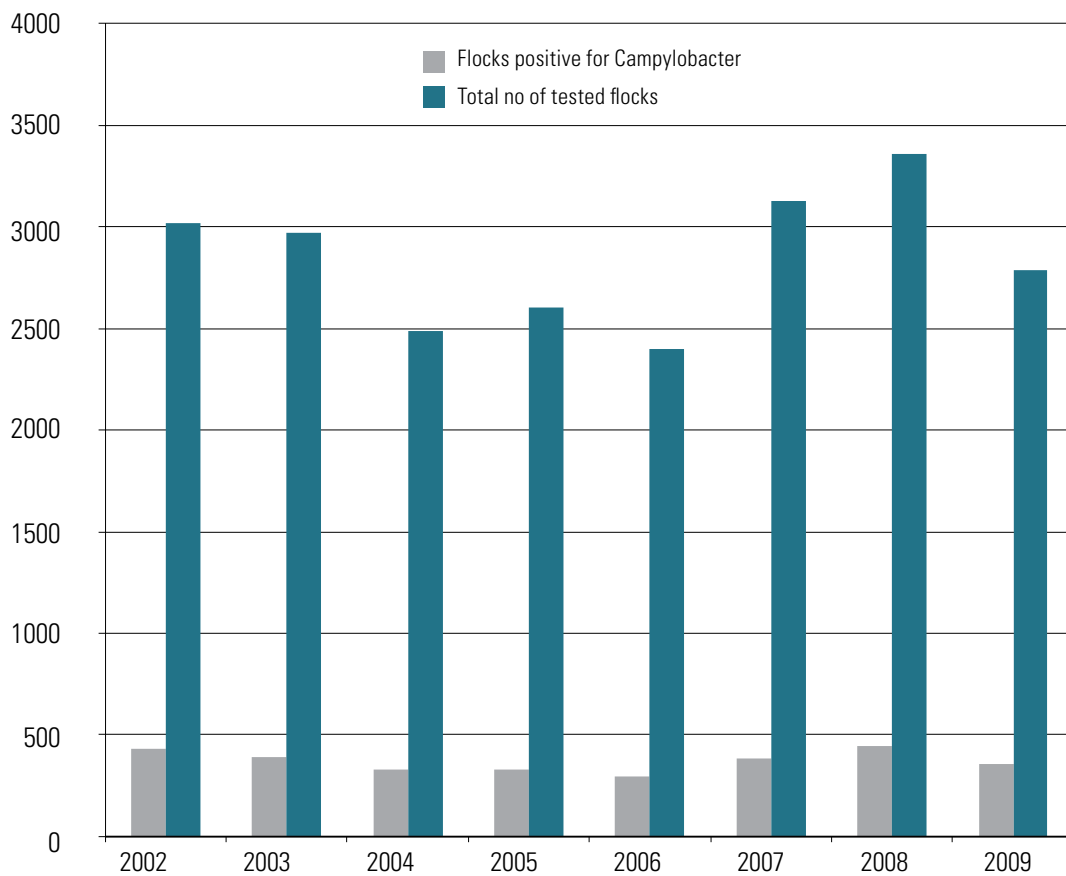
The local health authorities reported approximately 100 samples. Of these, two-thirds were taken as part of follow up of complaints or outbreak investigations. Three positive samples were reported.

*Campylobacter* was detected in 39 (63%) of imported fresh 62 broiler meat samples.

### DISCUSSION

During the last fifteen years, the number of notified human cases of campylobacteriosis has remained at a high level. The annual prevalence of *Campylobacter* in broiler flocks at major abattoirs decreased in the beginning of the last decade but has remained at 12-13% in recent years (Figure 3). *Campylobacter* seems to be more prevalent in small scale flocks which might result from less stringent biosecurity measures. Although the number of samples of imported meat is small, it indicates that these products are more often contaminated with *Campylobacter* than the domestic ones from industrial production.

Reducing *Campylobacter* prevalence at farm level decreases the risk of human infection. Applying strict biosecurity measures has decreased the number of *Campylobacter* positive broiler slaughter batches in Sweden. Still, approximately 10% of producers often deliver *Campylobacter* positive slaughter batches accounting for 55% of the *Campylobacter* load of domestic poultry. Thus, more effective

Figure 3. Prevalence of *Campylobacter* in broiler flocks in 2006-2011.

measures to control colonization of broiler flocks would be needed. Since flies have been associated with spread of the infection, a fly control program has been introduced in some broiler houses. Also, several other control measures to reduce flock prevalence are under investigation.

Carcasses are easily contaminated at slaughter and at secondary processing which necessitates application of good hygienic practices. In order to prevent carry over from positive to negative batches at slaughter, flocks tested positive at farm level or from operators often delivering positive birds can be slaughtered separately from *Campylobacter*-free flocks. Also, freezing *Campylobacter* positive carcasses or scheduling them to heat-treatment would reduce the risk for consumers.

Strict hygiene in the kitchen is essential to avoid cross-contamination between contaminated food and food that will not be heated i.e. raw vegetables. Likewise good hygiene is important when preparing food at barbecues.

In order to decrease human incidence of campylobacteriosis a national 5-year strategy plan for

*Campylobacter* is in progress as a co-operation between the Swedish Board of Agriculture, National Food Agency, Swedish Institute for Communicable Disease Control, the National Board of Health and Welfare and the National Veterinary Institute.

#### REFERENCES

- Lindqvist R, Lindblad M. Quantitative risk assessment of thermophilic *Campylobacter* spp. and cross-contamination during handling of raw broiler chickens evaluating strategies at the producer level to reduce human campylobacteriosis in Sweden. *Int J Food Microbiol.* 2008; 121:41-52.
- Hansson I, Forshell LP, Gustafsson P, Boqvist S, Lindblad J, Engvall EO, Andersson Y, Vågsholm I. Summary of the Swedish *Campylobacter* program in broilers, 2001 through 2005. *J Food Prot.* 2007; 70:2008-14.
- Hansson I, Vågsholm I, Svensson L, Olsson Engvall E. Correlations between *Campylobacter* spp. prevalence in the environment and broiler flocks. *J Appl Microbiol.* 2007; 103:640-9.
- Lindblad M, Lindmark H, Lambertz ST, Lindqvist R. Microbiological baseline study of broiler chickens at Swedish slaughterhouses. *J Food Prot.* 2006; 69:2875-82.

# Classical swine fever



## BACKGROUND

Classical swine fever (CSF) is a dreaded disease of pigs caused by a pestivirus closely related to bovine virus diarrhoea virus and border disease virus. It is considered one of the most important and devastating pig diseases worldwide. During 1997-98 an extensive outbreak occurred in the Netherlands, Germany, Belgium and Spain. Since then outbreaks in Europe have been confined to more limited geographic regions although the outbreaks in Lithuania 2009 and 2011 involved very large farms and are thus considered extensive. CSF is present in the wild boar population in some European countries. Some Eastern European countries have had difficulties in controlling CSF in back yard and feral pigs although the situation has improved during recent years. The disease is also present in Asia and South America. CSF has not been diagnosed in Sweden since 1944.

CSF is a highly contagious disease that is transmitted by direct and indirect contact between animals. Feeding pigs infected swill is considered the

main means of spreading the disease to new areas. Due to this, swill feeding of pigs is prohibited in the European Union.

## DISEASE

CSF appears in different clinical forms; acute, chronic and a mild form with reproductive disturbances as the main clinical manifestation. The incubation period is 2-14 days and in the acute form of the disease high fever (42°C), shivering, weak hind legs, purple discolouring of the skin and diarrhoea is seen. Chronically infected animals exhibit a more diffuse clinical picture with intermittent fever, anorexia and stunted growth. In the mild form abortions is the main clinical sign.

## LEGISLATION

CSF is included in the Swedish Act of Epizootic diseases (SFS 1999:657 with amendments) and the control of the disease is regulated in detail through EU-directives.

## SURVEILLANCE

The purpose of the surveillance activities is to document freedom from CSF in the Swedish pig population and to contribute to the maintenance of this situation. The National Veterinary Institute (SVA) has been responsible for selection of samples, sample analysis and reporting to the Swedish Board of Agriculture.

The serological analyses of CSF and analyses for CSF virus genome and CSF virus culturing were performed at the National Veterinary Institute (SVA). CSF serology was done using a commercial kit (IDEXX® HerdChek CSFV Antibody Test Kit) and in case of positive ELISA results a confirming neutralization peroxidase-linked assay (NPLA) for detection of antibodies against CSFV was performed.

### Passive surveillance

As CSF is notifiable on clinical suspicion for both veterinarians and farmers, cases with suspect clinical signs will be investigated following notification to the Swedish Board of Agriculture. The following investigation is included: restrictions on the farm during investigation, sampling of sick or dead animals and examination of the herd for prevalence of clinical signs and production results. Due to the similarity of clinical signs, both diseases are investigated in suspicions of CSF or ASF. This regime is strongly recommended by the EU.

Ongoing testing of animals for export and at breeding centres adds to the passive disease surveillance of CSF.

### Active surveillance

In 2011, sera for the active surveillance were collected by systematic random sampling from the surveillance carried out by the Swedish Animal Health Service for porcine respiratory and reproductive syndrome (PRRS).

In addition, analyzes for CSF virus genome with PCR is included in the active surveillance of aborted foetuses from sows.

## RESULTS

### Passive surveillance

Fifteen investigations following clinical suspicion of CSF/ASF were carried out during 2011. In the majority of these, reproductive failure was the main clinical manifestation. Following investigation including sampling, the herds could be declared negative for CSF/ASF.

Samples originating from sampling for export and at breeding centres were all negative regarding CSF.

### Active surveillance

Serum samples from 2,262 pigs were analyzed regarding antibodies to CSFV. In none of these samples antibodies to CSFV could be demonstrated.

Within the surveillance of aborted foetuses, 34 foetuses from 22 herds were examined for CSF virus genome and all samples were negative.

## DISCUSSION

The results from the surveillance in Sweden regarding CSF during 2011 give additional documentation of freedom from this infection in the Swedish commercial pig population.

The present situation regarding CSF within the EU with an extensive outbreak close to Sweden in Lithuania emphasizes the need for both passive and active surveillance for CSF.

# Coccidiosis and clostridiosis in broilers

## BACKGROUND

Coccidiosis and clostridiosis are intestinal diseases that commonly affect broiler chickens around the world. Both diseases are major causes of economic losses and reduced welfare.

## DISEASE

Coccidiosis is caused by microscopic parasites (genus *Eimeria*) that invade the intestinal epithelium. *Eimeria* spp. are ubiquitous, resilient and host-specific parasites that are easily transmitted between birds by the faecal-oral route, especially when birds are kept on litter at high stocking density. The severity of the intestinal lesions is influenced by parasite and host factors, such as parasite species, infectious dose, host age and level of immunity. Generally, young broiler chickens are highly susceptible.

Clostridiosis is a multifactorial disease and the pathogenesis is not well understood. Clostridiosis is associated with proliferation of the bacterium *Clostridium perfringens* type A, which together with managerial factors and loss of mucosal integrity cause lesions in the intestines (necrotic enteritis) and liver (cholangiohepatitis).

Clinical signs of coccidiosis and clostridiosis range from clinical disease with significantly increased mortality rates to mild or subclinical forms, which are associated with reduced weight gain and impaired feed conversion. Clostridiosis is also a cause of condemnation at slaughter due to liver lesions. Both diseases may be prevented by in-feed ionophorous anticoccidials.

## LEGISLATION

The health control program regarding coccidiosis and clostridiosis in broilers is regulated in Swedish legislation (SJVFS 1998:131) and is administered by the Swedish Poultry Meat Association.

## SURVEILLANCE

The purposes of the surveillance are to document that the anticoccidials efficiently protect broilers from disease and to supervise the amount anticoccidials used. The long-term goal is to replace anticoccidials by other preventive measures.

Field control of anticoccidial efficacy is performed by a lesion scoring method in broiler chickens from selected farms. If the lesion score of an individual flock exceeds a certain level (2.5) an analysis of the feed regarding the concentration of anticoccidial is performed and an on-farm investigation concerning management and general health status is carried out. The occurrence of hepatic and intestinal lesions is surveilled at slaughterhouses, and if more than 0.5% of the birds in a flock are affected samples are sent for histological examination to SVA. Further, data are compiled on a quarterly basis from all slaughterhouses on the overall level of condemnations due to liver lesions.

## RESULTS AND DISCUSSION

In 2011, a lesion score of >2.5 was found in one out of 37 investigated broiler flocks. Samples for histological examination of liver were submitted from slaughterhouses from 39 broiler flocks with >0.5% condemnation due to liver lesions. Lesions consistent with clostridiosis (i.e. cholangiohepatitis) were observed in 34 out of the 39 flocks. Three out of six slaughterhouses reported condemnation levels exceeding 0.1% caused by liver disease for at least one quarter during 2011. It was concluded that there are currently no indications of reduced efficacy of anticoccidials in Sweden. No long-term trends towards reduced anticoccidial efficacy or increased prevalence of coccidiosis and/or clostridiosis were observed.



# Echinococcosis

## BACKGROUND

Echinococcosis is a common name for different diseases in humans caused by tapeworms belonging to the genus of *Echinococcus*. Although the genus contains several species, only the species of *E. granulosus* and *multilocularis* exist in Europe. The life cycles of these parasites are completely different but both require two hosts: a definitive and an intermediate host. Humans are dead-end hosts of these parasites and may become infected by accidental ingestion of the eggs.



Photo: Erik Ågren

# Alveolar echinococcosis

## BACKGROUND

*Echinococcus multilocularis* is endemic in large parts of Europe and has been reported to extend its geographical area. Although a rare disease in humans, alveolar echinococcosis is of considerable public health concern due to its high mortality if untreated as well as high treatment costs. The definitive hosts of this parasite are mainly foxes, but also raccoon dogs, dogs, coyotes and wolves can act as definitive hosts. Rodents, mainly voles serve as intermediate hosts. The main host, the fox, contracts *E. multilocularis* from eating infected rodents.

## History

Prior to 2010, *E. multilocularis* had never been detected in Sweden and no case of alveolar echinococcosis had been reported in Sweden. As a response to the finding of *E. multilocularis* in Denmark in foxes, an active monitoring program of the red fox (*Vulpes vulpes*) was implemented in Sweden in

2000. From 2000 to 2009, a total of 2,962 red foxes (*Vulpes vulpes*), 68 raccoon dogs (*Nyctereutes procyonoides*) and 35 wolves (*Canis lupus*) were examined for *E. multilocularis*: all with negative results. Samples from most foxes (n=2,675) were examined by ELISA (CoproAntigen ELISA) at the Institute for Parasitology, Zurich University, for the presence of the *E. multilocularis* coproantigen and the rest, plus those from which samples were ELISA positive, were examined using the sedimentation and counting technique (SCT) (n=726). The raccoon dogs and wolves were examined by SCT.

## DISEASE

### Animals

In the definitive animal host, the infection is asymptomatic. The main intermediate hosts, rodents, will usually die of the infection if not previously captured by a predator.

### Humans

In humans, alveolar echinococcosis may develop into a serious, potentially fatal disease characterized by tumour-like lesions in the affected organ. Because of the long incubation period the disease is most frequently seen in adults. The most common site of localization is the liver but other organs can also be affected. Symptoms depend on the site and size of the lesion. The incubation period for developing alveolar echinococcosis in humans is assumed to be between 5 and 15 years.

### LEGISLATION

#### Animals

Detection of the parasite is notifiable according to Swedish legislation (SJVFS 2002:16 with amendments).

Since 2004, all dogs and cats entering Sweden from other countries (except for certain countries) were required to be treated with praziquantel before entering Sweden as a preventive measure. The EU Regulation 998/2003 gave a transitional period for Sweden to maintain these rules until 31 December 2011.

#### Humans

Infection with *Echinococcus* spp. has been a notifiable since 2004 according to the Communicable Disease Act (SFS 2004:168).

### SURVEILLANCE

#### Animals

During 2010, 304 foxes were examined for *E. multilocularis*. A total of 103 were tested by SCT and 201 by egg PCR. One fox, a young female, shot in December 2010 in Västra Götaland county, in south-west Sweden and analyzed during 2010-2011. During spring 2011, an extended surveillance was implemented and 2985 hunter shot foxes from different parts of the country were analyzed with segmental sedimentation and counting technique (SSCT). In addition, 119 fecal samples from hunting dogs collected in the region of the first positive finding were analyzed with egg-PCR. In the same area 236 rodent were trapped and autopsied and all potential lesions examined by an in-house PCR.

### Humans

The surveillance in humans is passive.

### RESULTS

#### Animals

One of 304 foxes shot during 2010 was found to be positive in February 2011. The positive egg-PCR was confirmed by conventional PCR followed by sequencing. Furthermore, the intestine of the fox was examined by SCT and the parasites present were identified as *E. multilocularis*, both morphologically and by detection of parasite DNA by PCR and sequencing. Of the 2985 foxes collected during 2011, three were found positive: one in Västra Götaland, one in Södermanland and one in Dalarna County. All dogs and rodents were negative for *E. multilocularis*.

#### Humans

No cases of alveolar echinococcosis were reported in Sweden in 2011.

### DISCUSSION

Before 2010, *E. multilocularis* had never been detected in Sweden. Due to the finding of this parasite in four different regions it was concluded that the parasite is endemic in the country. Increased surveillance of foxes will continue to clarify the spread of the parasite and identify any future change in prevalence. Surveillance in intermediate hosts will also continue to try to identify the intermediate host(s) involved in the life cycle of *E. multilocularis* in Sweden. Based on the studies that exist today, the risk that humans should become infected, from eating berries or mushrooms or vegetables, is considered negligible.

Due to the finding of *E. multilocularis* there will be no legal requirement of deworming of pets entering Sweden. However, as the prevalence of the parasite in foxes is very low in Sweden (~0.1%) compared to many European countries, dog owners are recommended to deworm their dogs prior to entry to Sweden.

# Cystic echinococcosis

## BACKGROUND

Cystic echinococcosis is caused by *Echinococcus granulosus*. Domestic dog and wolves are the most frequent main hosts. Eggs of the parasite are excreted in faeces and thus to the environment where they can infect intermediate hosts such as cattle, horses and wild ruminants. The eggs develop into the larval stage (hydatid cyst) mainly in the liver and occasionally in other organs of the intermediate host. The main hosts get the infection when consuming organs containing larval cysts.

## HISTORY

Echinococcosis was earlier quite common in the northern parts of Scandinavia, where it had a connection to the possession of reindeers. In the 1990's *E. granulosus* was sporadically detected in moose and reindeer in Sweden.

## DISEASE

### Animals

In animals, the infection is usually asymptomatic.

### Humans

In humans, the main site of localization of cystic echinococcosis is the liver. However, other organs might also be involved, such as the lungs, heart or brain tissue. Infected patients may remain asymptomatic for years or permanently. Clinical signs of disease depend on the number of cysts, their localization and pressure exerted on surrounding organs or tissues. The incubation period for developing cystic echinococcosis ranges between several months to years.

## LEGISLATION

### Animals

Detection of the parasite is notifiable in all animals according to SJVFS 2002:16 with amendments.

### Humans

Echinococcosis has been notifiable according to the Communicable Disease Act since 2004 (SFS 2004:168).

## SURVEILLANCE

### Animals

All animals are inspected for cysts during routine meat inspection.

### Humans

The surveillance in humans is passive.

## RESULTS

### Animals

*E. granulosus* was not detected in any animals in 2011.

### Humans

In 2011, 19 cases of echinococcosis were reported, which is a decrease from the peak in number of cases in 2010.

Of the total number of reported cases 10 were women and 9 men aged 11 to 79 years (median age 40 years). They were considered infected in areas where the parasite is endemic and the most frequently specified countries of infection were Iraq (7 cases), Afghanistan (3 cases) and Turkey (3 cases).

## DISCUSSION

*E. granulosus* has not been detected in Sweden in animals since the late 1990's, when it was reported in reindeer in the northernmost regions of Sweden, bordering on Norway and Finland. The parasite is prevalent in several European countries. In Finland it has occurred in wildlife (wolves, elk and reindeer); in other European countries mainly in a cycle of dogs-farm animals.

# Enzootic Bovine Leucosis

## BACKGROUND

Enzootic bovine leucosis (EBL) is caused by bovine leukemia virus, which is an oncovirus in the family Retroviridae. Infection occurs by transfer of infected lymphocytes for example via contact with contaminated biological material from an infected animal.

Sweden was declared officially free from enzootic bovine leucosis (EBL) by the European Union (EU) in January 2001 (former Decision 2001/28/EC, currently Decision 2003/467/EC last amended by Decision 2005/764/EC). Before this, a voluntary control program had started in 1990 and a mandatory eradication program had been running since the autumn of 1995.

## DISEASE

EBL is characterized by multiple cases of multicentric lymphosarcoma in adult cattle within a herd after an incubation period of 4-5 years. The tumours can develop rapidly in many sites, which may cause variable clinical signs depending on the site. Persistent lymphocytosis without clinical signs occurs earlier but rarely before 2 years of age.

## LEGISLATION

EBL is included in the Swedish legislation regarding notifiable diseases (SJVFS 2002:16). EBL is also on the OIE list of infectious diseases and current surveillance standards are given in EU legislation, Directive 64/432/EEC.

## SURVEILLANCE

The purpose of the surveillance is to document freedom from EBL in accordance to Directive 64/432/EEC. The Swedish Dairy Association is responsible for this surveillance, which is approved and financed by the Swedish Board of Agriculture.

From 2010 surveillance in dairy herds is performed by random sampling of at least 1,700 herds every year. Milk samples are collected within the quality control programmes of the dairies. The surveillance in beef herds is performed by random sampling of at least 2,900 herds every year. Serum is collected from slaughtered cattle above 2 years of age in sampled herds.

Diagnostic testing is performed at the National Veterinary Institute (SVA), Uppsala, Sweden. Both milk and sera are analyzed using an antibody ELISA (Svanovir BLV GP-51 ELISA).

## RESULTS

During 2011, no herd was diagnosed with EBL.

## DISCUSSION

As no herd was diagnosed with EBL 2011 Sweden has now been declared free from EBL for over 10 years indicating a very stable disease-free situation.

## REFERENCES

Swedish Dairy Association, Statistics for 2011.

# Footrot

## BACKGROUND

Footrot is a world-wide contagious disease in sheep and goats. The causative agent is *Dichelobacter nodosus* (*D. nodosus*), in conjunction with *Fusobacterium necrophorum*. Predisposing factors are humid and warm weather conditions, and inter-digital dermatitis is a precursor to footrot. The severity of footrot depends on the strain of *D. nodosus* and the environmental conditions.

The first case of footrot in Swedish sheep was diagnosed in 2004. Data from all affected flocks have been documented since 2004. A prevalence study on slaughter lambs was performed in 2009. A voluntary control program (“Klövkontrollen”) was launched by the Swedish Animal Health Service in 2009.

## DISEASE

The clinical signs are typical foot lesions, and lameness due to the painful lesions. Lameness is, however, not a consistent clinical sign in all affected sheep. Footrot may vary in severity from inflammation of the interdigital skin to complete underrunning of hoof horn.

## LEGISLATION

Footrot is a notifiable disease (SJVFS 2002:16 with amendments).

## SURVEILLANCE

The aim of the control program is to eliminate footrot from affected sheep flocks and to provide certificate for footrot-free sheep trade. Another important part of the program is training for veterinary practitioners and non veterinary staff to perform clinical inspection and footrot scoring.

The program is based on foot bathing, moving to clean pastures and culling of chronically infected sheep. Feet are inspected by veterinarians and sheep farmers on an annual basis. The inspections are performed during August to October, when the risk for footrot increases due to weather conditions. If no signs of footrot are detected, the flock is certified (F-status). Flocks with a history of footrot can be certified a year after elimination of the infection.

Diagnostic testing is performed at the National Veterinary Institute (SVA), Uppsala, Sweden. Development of additional diagnostic tools are also linked to the control program.

## RESULTS

During 2004-2010, footrot was reported in 159 sheep flocks. Following the recommended measurements in the control program, footrot was eliminated from 70 % of the flocks, which were certified free. In 2011, 10 flocks were detected with footrot.

## DISCUSSION

Good collaboration between authorities, the sheep farming community and individual sheep farmers has resulted in a cost-effective control program.

## REFERENCES

U König, A-K J Nyman, K de Verdier: Prevalence of footrot in Swedish slaughter lambs. *Acta Veterinaria Scandinavica* 2011, 53:27.

# Infectious Bovine Rhinotracheitis

## BACKGROUND

Infectious bovine rhinotracheitis (IBR) is caused by Bovine herpes virus 1. The same virus can affect different organ systems causing respiratory, abortive, genital or conjunctival disease. Transmission is mainly by aerosol for the respiratory form and by venereal transmission for the genital form.

Examination of Swedish bulk milk samples during the early nineties showed the presence of a small number of seropositive herds. No signs of clinical disease were present in these herds. An eradication program was initiated in 1994 and the last seropositive animal was found in 1995.

## DISEASE

The incubation period for IBR is 3-21 days, but virus can be silently present in the host animal and be reactivated by stress or immunosuppression. The clinical picture varies with the subtype of the virus but also with the environmental and surrounding factors. Several manifestations of the disease can be present in the same outbreak in the same herd, the symptoms being concentrated either to the respiratory tract, reproductive organs or the eyes.

## LEGISLATION

The Swedish IBR eradication program was approved in 1994 (Decision 73/94/ COL and Decision 95/71/EC). Sweden was allowed additional guarantees relating to IBR in 1995 (Decision 95/109/EC) and was officially declared free from IBR in 1998 (former Decision 98/362/ EC, current Decision 2004/558/EC). Since 2004, all neighbouring Nordic countries have additional guarantees relating to this disease (Decision 74/94/ COL and Decision 95/71/EC). IBR is included in the Swedish Act of Epizootic diseases (SFS 1999:657 with amendments). Vaccination is prohibited and notification on clinical suspicion is mandatory.

## SURVEILLANCE

All diagnostic testing as outlined below was performed at the National Veterinary Institute (SVA). Milk and sera were analyzed for presence of antibodies using an indirect ELISA (SVANOVIR™ IBR-ab, SvanovaR). A blocking-ELISA IBR/BHV-1 gB Ab ELISA kit (IDEXX) was used for confirma-

tory testing. Semen and organ samples were tested with a real time PCR. A positive case is defined as an animal with a positive PCR result or a confirmed positive serological reaction.

## Passive surveillance

Suspicious based on clinical signs must be reported to the Swedish Board of Agriculture and subsequently investigated.

In addition to the clinical surveillance, bulls are tested at semen collection centres and bovine animals are tested at export or import, including the more exotic species such as musk-ox, elk, buffalo, and alpaca. During 2011, 100 semen samples from 56 animals were tested at semen collection centres and 176 animals were tested prior to import or export.

## Active surveillance

The purpose of the surveillance is to document freedom from IBR. The Swedish Board of Agriculture is responsible for the surveillance, which is coordinated by the Swedish Dairy Association. Within the surveillance program dairy herds are tested with bulk milk samples, in farms with more than 50 cows pooled milk samples are used. The sampling is conducted twice yearly within the Dairy association's quality control program and synchronized with the programs for bovine viral diarrhoea and enzootic bovine leucosis and thus not strictly random. The surveillance also includes serum samples from beef cattle. In 2011 3,165 bulk milk samples and 7,004 serum samples from beef cattle were examined.

## RESULTS

In 2011 four cases were investigated with serology and/or PCR, due to clinical suspicion of IBR. Diagnostic testing ruled out the suspicions.

All other samples tested in 2011 were also negative.

## DISCUSSION

In summary no herd or individual animal were diagnosed with IBR infection during 2010. This supports Sweden's IBR free status.

# Influenza

## BACKGROUND

Influenza is a viral disease affecting both birds and mammals, including humans. The causative agent is a RNA-virus of the family *Orthomyxoviridae* that is highly inclined to change over time and new strains are created both through mutations (“antigenic drift”) and through mixing of existing strains (“reassortment”). Influenza viruses are classified into subtypes based on their surface antigens, hemagglutinin (H) and neuraminidase (N).

The main mode of transmission of influenza virus is by aerosols containing virus from the airways of infected individuals of the same species. Occasionally influenza virus can be transmitted from one species to another, like in the case with avian influenza infecting humans, but the main rule is that each species has their own influenza viruses.

# Avian Influenza

## BACKGROUND

Avian influenza (AI) is caused by Influenza A viruses. The viruses belong to different antigenic subtypes based on hemagglutinin (H1-H16) and neuraminidase (N1-N9) surface structures. The disease is highly contagious and is spread both directly and indirectly. Wild birds are reservoirs for low pathogenic viruses (LPAIV), which may mutate and become highly pathogenic (HPAIV) if introduced in poultry flocks. Since 2005 highly pathogenic H5N1 virus has affected and been spread by wild birds in Asia, Europe and Africa. In early spring of 2006 highly pathogenic avian influenza (HPAI) of subtype H5N1 was for the first time detected in wild birds in Sweden. One infected farmed mallard was also detected in a game bird holding.

In 2011 there were no outbreaks of HPAI, but 44 outbreaks of LPAI reported in Europe: Germany (n=23), Netherlands (n=4) and Italy (n=17).

### Animals

Morbidity in birds may be as high as 100%, but depends on species affected, co-infections, virulence in the virus and other factors. In general, gallinaceous birds including turkeys and chickens suffer a more severe disease than waterfowl as ducks and geese, which may only express minor clinical signs, if any. LPAIV infections most often cause asymptomatic infections or mild respiratory disease. HPAIV

infections cause variable clinical signs like cyanosis, respiratory distress, diarrhea, nervous signs, depression, decreased food and water intake, decreased egg production with altered egg quality. In some cases the only sign is sudden death of large numbers of birds.

### Humans

Since 2003 more than 600 human cases of H5N1 infection have been determined with a death rate of 59%. According to WHO, most of the positive cases are diagnosed in Egypt and Indonesia. The majority of human cases of H5N1 infection has been associated with direct or indirect contact with infected live or dead poultry. Controlling the disease in animals is the first step in decreasing risks to humans.

## LEGISLATION

### Animals

Highly pathogenic avian influenza of all subtypes as well as low pathogenic avian influenza of H5 and H7 subtypes are included in the Swedish Act of Epizootic diseases (SFS 1999:657 with amendments) and are notifiable on suspicion. If AI is suspected or confirmed on a farm, measures will be taken to combat the disease and to prevent further spread according to Council Directive 2005/94/EC.

### Humans

H5N1 infection is notifiable according to the Communicable Disease Act (SFS 2004:168).

### SURVEILLANCE

The Avian Influenza surveillance program in Sweden in poultry and wild birds 2011 was based on Council directive 2005/94/EC and Commission decision 2010/367/EU.

The surveillance programs have been annually carried out in all member states since 2002 to determine the prevalence of avian influenza, in particular the subtypes H5 and H7. The aim of the surveillance in poultry is to detect infections of avian influenza virus subtype H5 and H7 in different species of poultry. Surveillance of wild birds contributes to the knowledge of the threats from wildlife to animal health and serves as an early warning system of avian influenza that may be introduced into poultry flocks.

### Poultry

In 2011 sampling was performed in game birds (mallard ducks and pheasants), layers, turkeys, breeders, geese, ducks, ratites and small-scale broiler production. Ten blood samples from each holding were collected except for holdings with geese, ducks and mallard ducks where 20 samples from each flock were collected. All birds were sampled in flocks with less than 10 and 20 birds. In total 2,809 samples were taken. Table 2 gives an overview of all poultry flocks sampled in 2006 to 2011. In addition to the surveillance program, samples taken on suspicion, including clinical suspicion for Newcastle disease, were analyzed for AIV.

The serological analyses were performed at the National Veterinary Institute (SVA). All poultry were sampled at slaughter except for breeders and game birds. These two categories were bled at their holdings. Breeders were sampled late in their produc-

tion period. Samples were analyzed using an ELISA (Terregino C. Evaluation of sensitivity and specificity of a commercial competitive avian influenza type A antibody ELISA kit (IDVET® Screen Influenza A), Istituto Zooprofilattico Sperimentale delle Venezie, Legnaro (Padova), Italy, OIE-FAO and National Reference Laboratory for Newcastle Disease and Avian Influenza). Positive results were confirmed with haemagglutination inhibition tests (for subtypes H5 and H7) in accordance to the guidelines.

### Wild birds

The surveillance in wild birds is passive and based on birds found dead or diseased. From birds that were autopsied, swab samples (both cloacal and tracheal) were used for PCR analyses. The samples were analyzed for the detection of avian influenza virus genome by using an M-gene realtime PCR. Positive samples were further analyzed for detection and identification of H5 and H7 viruses, including virus pathotyping by amplicon sequencing.

In total 194 birds, 96 predator birds, 23 waterfowl or shorebirds and 75 of other groups, were sampled within the passive surveillance carried out by SVA (Map 6). During the previous 5 years there has been an active surveillance of 2000-4,500 wild birds sampled yearly. From 2011 onwards, the surveillance is directed to submitted dead birds only.

### Humans

Every year during the influenza surveillance season 1,500-2,000 samples are collected from patients with influenza like illness. These samples are analysed for influenza A. If Influenza A is detected further subtyping is performed. The Swedish Institute for Communicable Disease Control also performs a specific PCR for A/H5N1 if requested.



Table 2. Number of flocks of different poultry categories sampled in 2006-2011.

	2006	2007	2008	2009	2010	2011
Laying hens <sup>1</sup>	60	60	65	61	62	61
Free-Range laying hens <sup>1</sup>	n/a	n/a	n/a	n/a	n/a	30
Turkeys	26	23	23	17	21	22
Ducks	2	3	8	3	4	6
Geese	28	16	30	13	11	20
Broilers <sup>2</sup>	7	17	28	27	24	39
Ratites	15	10	10	6	4	5
Breeding hens (parents)	40	40	42	33	34	36
Breeding turkeys (parents)	4	4	2	4	3	3
Game birds (mallards)	0	7	6	6	7	9
Game birds (pheasants)	0	23	23	20	17	15
Backyard flocks (geese, ducks)	0	0	0	6	0	0

<sup>1</sup> Between 2006 and 2010 sampling of all laying hens were reported under the same category regardless of housing system. From 2011 free-range (organic) laying hens are reported separately while the category 'laying hens' includes hens in furnished cages and indoor litter-based housing systems.

<sup>2</sup> Small-scale production.

## RESULTS

### Poultry

Antibodies to avian influenza virus subtype H5 and H7 were not detected except for in total five samples from two holdings, which were positive for H5. The two holdings, both game farms with mallards, were further investigated by swab sampling. No influenza A virus genome was detected in samples from the holdings.

### Wild birds

Within the passive surveillance, 194 birds of 53 different species were sampled and all birds were negative for Influenza A viruses.

### Humans

A/H5N1 has not been determined in any human sample in Sweden.

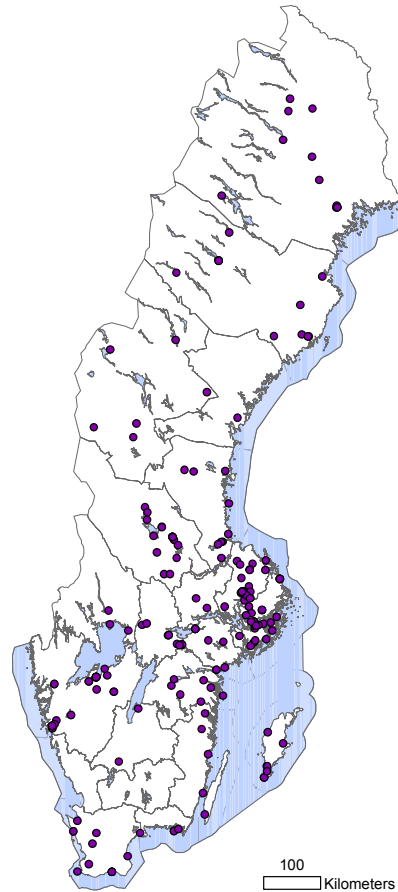
DISCUSSION

The first large outbreak of HPAI in wild birds was reported from China in May 2005. Thereafter wild birds infected with HPAI have been detected in Europe. Although no great mortality has been observed in wild birds, they pose a risk for domestic birds since the virus is directly pathogenic for poultry. In Sweden and the rest of Europe preventive measures have been focused on increased biosecurity in poultry holdings to prevent the transmission of the virus from wild birds. These measures are still very important but once introduced to poultry the virus is more likely to further spread between poultry flocks via infected live animals, contaminated vehicles, products etc. Therefore, continuous biosecurity measures are important to prevent the spread of virus that, if introduced, could be transmitted before a diagnosis. When combating the disease focus should be on preventive measures in order to reduce transmission of virus between poultry flocks.

The numbers of wild birds sampled have gradually decreased since the situation regarding HPAI H5N1 has stabilized. Highly pathogenic avian influenza has mostly been found within the passive surveillance, while the low pathogenic strains have been detected within the active surveillance. Therefore, the European Commission will no longer economically support active surveillance in wild birds. Also the Swedish surveillance program in wild birds has been changed accordingly.

Influenza viruses are unpredictable and changes (mutations or reassortment) might be induced. This might enable the virus more transmissible among humans. Monitoring of human infections with these viruses is critically important to assess their pandemic potential.

Map 6. Distribution of fallen wild birds sampled in passive surveillance of avian influenza 2011



# Porcine Influenza

## BACKGROUND

The most common swine influenza virus subtypes internationally are H1N1, H1N2 and H3N2. Of these, the H1N1 swine influenza virus was reported to infect pigs in North America already in 1918.

During 2009 a new pandemic type of H1N1, partly of porcine origin, began circulating in people and this virus has occasionally infected swine by transmission from humans in a number of countries including Norway, Denmark and Finland.

### Animals

Porcine influenza H1N1 was isolated from Swedish pigs for the first time in 1982. The clinical signs were severe in the previously naive pig population but got milder over time. The H1N1 virus is since 1982 established in the country and has become endemic. Influenza H3N2 is also present in the Swedish pig population. Antibodies to H3N2 were first detected in a serologic screening performed in 1999. Since the clinical signs were not as evident as when H1N1 was introduced and the H3N2 was detected in screening of apparently healthy animals it is less clear when this subtype was introduced. However, H3N2 has since 1999 occasionally been correlated to severe respiratory illness.

Another porcine influenza A type (H1N2) that has been spread through Europe, was diagnosed for the first time in Sweden in a large multisite unit with respiratory disease in growers during the winter 2009.

There has been no regular monitoring for influenza in pigs in Sweden, but SVA has managed to run serological screenings during 1999, 2002 and 2006 for the presence of serum antibodies in 1,000 porcine sera. The screening in 2006 also included analyses for antibodies to H5 and H7.

Infection with influenza virus can produce clinical respiratory disease manifested as dyspnoea, sometimes with nasal discharge and cough, accompanied by fever, inappetence and inactivity. The disease can affect pigs of varying age and the severity of clinical sign varies from severe respiratory disease to sub-clinical infection. The morbidity of affected herds is generally high whereas mortality is low.

### Humans

Globally 5-10 human cases of influenza virus infections with domains associated to pigs are reported

every year. However, human-to-human transmission of such reassorted virus types are rarely reported. An exception is, the pandemic in 2009, which was caused by A(H1N1) pdm 09 (triple reassortant). Since August 2011, twelve humans cases infected with swine-origin influenza A(H3N2)v (triple reassortant) were diagnosed in the USA (in five states). For six of the cases no exposure to swine was reported. Human-to-human transmission was suspected. Eleven of the cases occurred in children under 10 years of age. Swine influenza virus (SIV) H3N2 with triple reassorted internal genes has been enzootic in US since 1998. The transmission of the A(H1N1)pdm09 virus to pigs in the US was followed by reassortment with endemic SIV. This resulted in reassorted viruses that includes the novel H3N2 genotypes. The swine-origin H3N2v strain includes the M (matrix) gene from the A(H1N1) pdm09 virus.

## LEGISLATION

Influenza in pigs is not regulated in the Swedish legislation.

Sustainable transmission of influenza among humans with a virus originating from another host will be a notifiable disease.

## SURVEILLANCE

### *Passive surveillance*

During 2009 to 2011, samples from pig herds with respiratory signs that could be associated with influenza were collected with the aim to analyze the samples for presence of the pandemic influenza A (H1N1)pdm09 virus using a polymerase chain reaction (PCR)-method. From each affected herd 5-10 nasal swab samples were collected and analyzed in a stepwise mode; samples positive for swine influenza A were further analyzed for pandemic influenza A (H1N1)pdm09. Furthermore, these samples were also investigated regarding other influenza A types.

### ACTIVE SURVEILLANCE

The surveillance in 2010 included 1,008 porcine sera collected at slaughter. These sera were randomly selected from the PRRS control program and included a maximum of four sera per herd and sampling occasion. These sera were monitored for

antibodies to Swine influenza types H1N1, H1N2 and H3N2 using HI-tests. HI-titers  $\geq 1:64$  were regarded to reflect significant levels of serum antibodies. Regarding the recently demonstrated influenza H1N2-virus, two HI-tests were carried out, one using a traditional strain and one based on the strain isolated in Sweden (the 9706-strain).

## RESULTS

### Animals

#### Passive surveillance

Samples from totally 21 herds with respiratory signs were analyzed for swine influenza virus in 2009 to 2011. In four of these herds influenza A virus was detected, but in no case was pandemic influenza A (H1N1) virus found.

#### Active surveillance

The surveillance in 2010 revealed low frequencies of pigs with significant levels of antibodies to Swine influenza types H1N1, H1N2 and H3N2 using HI-tests (Table 3). It is however notable that the prevalence of pigs with significant levels of antibodies to H1N2 increased somewhat when the analysis was based on the recent Swedish isolate of the strain.

### Humans

During this season 2010-2011 more than 1,200 A/H3 has been determined with H3 specific PCR systems. All samples with irregular PCR-plots have been analysed by sequencing. A specific real-time PCR system to distinguish between humans A/H3N2 and the A/H3N2v has been developed and samples from children will be analysed.

## DISCUSSION

The results indicate presence of, but no large impact of Swine Influenza in the Swedish pig population. In the serological screening carried out in 2010, the incidence of influenza was low with respect to H1N1 and H3N2. The prevalences of pigs with significant levels of serum antibodies were lower during 2010 than in 2006. Also the prevalence of pigs with significant levels of serum antibodies to H1N2 was low, regardless of the origin of viral strain used for the analysis. The reactions defined as low rather indicated unspecific reactions than true antibodies to the influenza strains analyzed for. Still, the difference in results depending on H1N2-viral strain used for analysing indicates the necessity to include relevant influenza strains (Table 3). The new pandemic form of H1N1 affecting pigs internationally has not yet been detected in pigs in Sweden.

Influenza viruses are unpredictable and changes (mutations or reassortment) might be induced. This might enable the virus more transmissible among humans. Monitoring of human infections with these viruses is critically important to assess their pandemic potential.

## REFERENCES

Kiss, I., A. Bálint, G. Metrevelli, E. Emmoth, F. Widén, S. Bélaç and P. Wallgren (2010). Swine influenza isolated in 1983, 2002 and 2009 in Sweden exemplify different lineages. *Acta Vet Scand.* 52:65.

Wallgren, P, Paulsson, M. Gerth Löfstedt, M. (2009). Ny influensastam, H1N2, påvisad hos gris i Sverige (Influenza H1N2 demonstrated in Swedish pigs). *Svensk VetTidn.* 61 (14) 11-17.

Table 3. Reactors from the serosurveys performed 2006 and 2010. The table shows the prevalence of significant seroreactors to the three porcine adapted strains of influenza present in the country. The table also shows the prevalences with low reactoion in the HI-tests. Note the difference in prevalences depending on strain used for antibody detection for H1N2 in 2010.

Seropositive samples	H1N1	H3N2	H1N2-standard	H1N2 new (9706strain)
Significant levels of antibodies ( $\geq 1:64$ )				
2006 (n=999)	33.0%	6.7%	0.6%	-
2010 (n=1,008)	0.6%	3.7%	0.1%	0.9%
Low levels of antibodies ( $\leq 1:32$ )				
2006 (n=999)	15.1%	18.8%	7.0%	-
2010 (n=1,008)	2.3%	9.6%	1.3%	5.1%

# Leptospirosis

## BACKGROUND

Several species of the spirochetal bacteria of *Leptospira* can cause leptospirosis. The disease is associated with reproductive losses in cattle and significant economic costs worldwide, but may also cause disease in humans. Many countries in Europe have screening programs for *Leptospira interrogans* serovar *hardjo* (*Leptospira hardjo*). Regarding surveillance for *Leptospira pomona* in pigs, see chapter on Additional surveillances; Infectious diseases in pig herds.

*Leptospira* may be transmitted directly between animals or indirectly in the environment. The bacteria do not multiply outside the host, but may survive for long periods in the environment.

## DISEASE

### Animals

*L. hardjo* is one of several pathogenic serovars and is associated with disease in cattle, sheep, goats and horses. Infections may be acute or chronic, asymptomatic, mild or severe. Acute disease is more often seen in calves. Disease in adult cows may go unnoticed, as early symptoms as fever and depression often are transient and mild. Infected herds may have problem with abortions, decreased fertility and decreased milk yield as well as increased mortality in calves. The symptoms in sheep and goats are similar to those in cows. Sheep and cattle can act as reservoir hosts if having asymptomatic disease.

### Humans

Leptospirosis in humans ranges from asymptomatic or mild, influenza-like illness to a severe infection with renal and hepatic failure, pulmonary distress and death.

## LEGISLATION

### Animals

Since 2004, leptospirosis is a notifiable disease in Sweden (SJVFS 2007:90, with amendments).

### Humans

Leptospirosis in humans is notifiable according to the Communicable Disease Act (SFS 2004:168).

## SURVEILLANCE

### Animals

From 1994 to 2006, approximately 3,000 samples (bulk milk and/or serum samples) have been tested for *Leptospira hardjo* in bovines each year. Since 2006 sampling and testing for antibodies to *L. hardjo* is not performed every year. Last screening was performed in 2010, where both bulk milk samples as well as blood samples were included. A total of 2,496 blood samples were randomly selected at several slaughterhouses within the surveillance program for bovine virus diarrhea (BVD) and evenly distributed throughout the sampling period. In addition 750 bulk milk samples were selected by systematic random sampling from the surveillance program for BVD. Ongoing testing of animals for export and at breeding centers in 2011 resulted in 54 sera from cattle that were analysed for *L. hardjo* in a passive surveillance.

Diagnostic test used for both blood samples and bulk milk samples was an indirect ELISA (Prio-CHECK *L. hardjo*, Antibody detection ELISA, Lelystad, Holland). Positive blood samples were further tested with MAT (Microscopic agglutination test). For positive or doubtful ELISA results on bulk milk samples, an investigation was carried out in the herd and additional sampling of individuals were taken.

### Humans

The surveillance in humans is passive.

## RESULTS

### Animals

All samples were negative for antibodies to *L. hardjo* in the passive disease surveillance. For the screening program in 2010, all samples but one were negative for antibodies to *L. hardjo*. The result from one bulk milk sample was doubtful. However, the dairy herd was investigated and individual sampling of five dairy cows was performed as well as collection of a new bulk milk sample. There were no clinical signs suggesting *L. hardjo* infection in the herd and all samples turned out to be serologically negative.



#### Humans

In 2011, four cases of leptospirosis were reported. Two cases were probably infected in Asia, one in South-America and for one case the country of infection was unknown. The cases which are imported to Sweden have often acquired their infections during leisure activities in contact with water.

#### DISCUSSION

Leptospirosis occurs worldwide, but the predominant serovars vary by geographic region. The disease is associated with reproductive losses in cattle and significant economic costs worldwide. Some *Lepto-*

*spira* serovars may be present in Sweden. However, the surveillance of *L. hardjo* that has been in place since 1994 suggests that this serovar is not present in the country. Since 2006 the surveillance program in cattle is no longer performed each year because the serological screening of *L. hardjo* is considered of less importance compared to screening programs of other contagious animal diseases. Also, human infections are mainly travel-associated. The Swedish Board of Agriculture can decide on an epidemiological investigation in case of clinical disease suggesting leptospirosis in animals.

# Listeriosis

## BACKGROUND

The genus *Listeria* contains several species but the only zoonotic species, *Listeria monocytogenes* was first described in 1926. Previously, sporadic cases of listeriosis were reported, often in employees in contact with diseased animals but since the 1980's outbreaks of listeriosis have been traced to food products.

*Listeria* bacteria are widely distributed in the environment, such as in soil, silage and water. They can survive for long periods in the environment and tolerate disinfection and also grow at refrigeration temperatures. These properties make elimination of *L. monocytogenes* difficult. The main sources of human listeriosis are contaminated food products, such as smoked or marinated vacuum-packaged fishery products, meat products and soft cheeses or other ready-to-eat foods with long shelf-life. The infection can also be transmitted from infected animals to humans or via person-to-person contact. The environment and animals serve as important reservoirs of the pathogen.

*L. monocytogenes* is destroyed by heating (pasteurization and cooking). The bacterium is able to grow in vacuum-packed food, at refrigeration temperatures and in modified atmospheres. *L. monocytogenes* is often found as an environmental contaminant in food premises.

In Sweden, during the last ten years approximately 40-60 cases have been reported annually. Outbreaks have been associated with vacuum-packaged fish (1995-1996) and with cheese made of raw goat milk (2001). During the later years, an increasing trend for cases of listeriosis has been noted both in Sweden and internationally. In 2009, the highest number of cases ever was reported (73 cases). Although the number of cases has decreased since 2009, the overall increasing trend remains.

## DISEASE

### Animals

*L. monocytogenes* can infect a wide range of animal species, both domestic and wild. Animals may be asymptomatic carriers and shed the organism but especially sheep may develop clinical disease, such as neurological symptoms, abortions, mastitis or septicemia.

### Humans

Listeriosis can be manifested either as a milder non-invasive form or as a severe invasive disease. The non-invasive form is mainly febrile gastroenteritis. A severe form mostly occurs in immuno-compromised persons, the newborn, pregnant women and elderly people. Symptoms for the invasive listeriosis are septicemia, meningitis and meningoencephalitis. For those with severe infection, the fatality rate is high (20-40%). The infection can lead to miscarriage, premature delivery or neonatal death. The incubation period of listeriosis varies from 3-70 days, the average being about 21 days.

## LEGISLATION

### Animals

Listeriosis is notifiable in animals according to (SJVFS 2002:16 with amendments).

### Food

Criteria for *L. monocytogenes* in foods are specified in EU-regulation on microbiological criteria (EC 2073/2005). Food business operators shall ensure that foodstuffs are in compliance with the regulation. Different criteria apply for ready-to-eat (RTE) foods in which growth of *L. monocytogenes* can occur and in RTE foods in which growth of *L. monocytogenes* will not occur during their shelf-life.

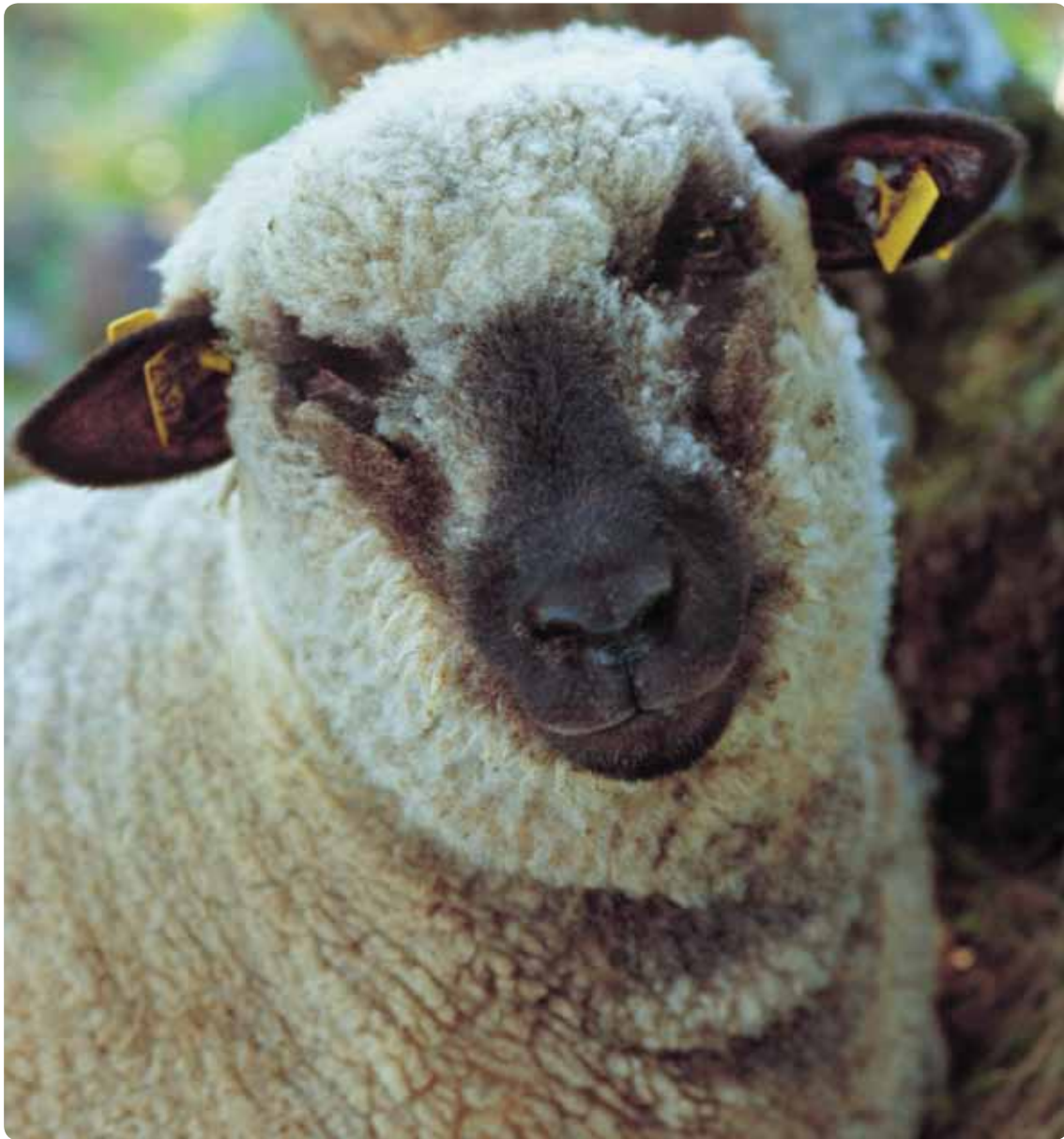
### Humans

Listeriosis has been a notifiable disease in Sweden since 1960. It is notifiable in humans for both clinicians and laboratories according to the Communicable Disease Act (SFS 2004:168).

## SURVEILLANCE

### Animals

There is no active surveillance system. Notifications are based on clinical cases and laboratory analyses. The diagnosis can be based on histological or macroscopical findings at necropsy or by detection of the organism by cultivation methods using enrichment in selective broth followed by culture on selective and non-selective agar. Identification is made by biochemical methods. The Swedish Board of Agriculture can decide on epidemiological investigations if needed.



#### Food

No official control program exists. Sampling is performed by national and local authorities, mainly at retail level but also at production units. Sampling performed by the industry is not normally reported to the authorities. Analysis is based on cultivation methods according to EN/ISO 11290-1 and 11290-2 or NMKL 136 or other methods available at accredited laboratories.

#### Humans

The surveillance in humans is passive. Isolates from human cases are sent to SMI for typing using the method provided by the Listeria reference laboratory in Paris.

### RESULTS

#### Animals

In 2011, listeriosis was reported in 29 sheep, four cattle, three goats and one horse.

#### Food

The local authorities reported approx. 500 samples of various food products that were analyzed qualitatively. *L. monocytogenes* was detected in seven of these samples.

In 2010, a national survey was run in cooperation between the National Food Agency and the local authorities. In addition, Sweden participated in an EU-wide baseline survey targeting the same three categories of RTE foods as the national survey, (i) packaged heat-treated meat products, (ii) soft and semi-soft cheeses and (iii) packaged gravad and smoked fish. The combined results of the two surveys (the national survey and the Swedish part of the EU-wide survey) are presented in a paper at present submitted for publication (ref 1). In all, 1,590 food samples were analysed and they generated 83 *L. monocytogenes* isolates, 70 isolated from fish, 10 from meat and 3 from cheese. During the same time period (2010) 31 *L. monocytogenes* isolates were found



in processing plant environment and on equipments. All isolates, food and environmental, were subtyped during year 2011, i.e. serotyped using PCR and agglutination and genotyped using pulsed-field gel electrophoresis. Likewise, the human isolates recovered from listeriosis cases occurring during year 2010 were subtyped. In the near future a report will be put together on the subtyping results covering the isolates from food, processing plants and humans all collected during 2010

In 2011, National Food Agency participated in the work to set up a European open database (EU-ODB) for the exchange between the Member states of *L. monocytogenes* PFGE profiles isolated from food and food environment.

#### Humans

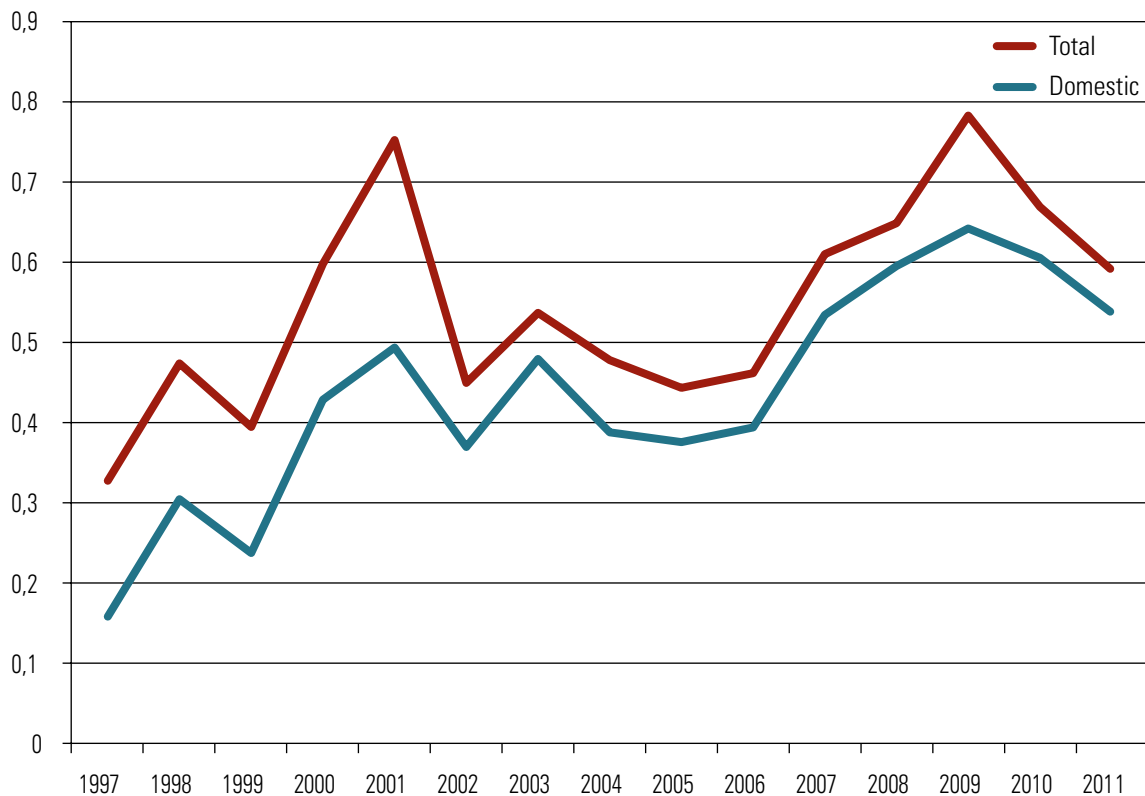
In 2011, 56 cases of listeriosis were reported (incidence 0.59 cases per 100,000 inhabitants). This is a decrease with 11% from the higher number the year before (63 cases), but is still a high incidence seen in a longer time frame (Figure 4). No larger outbreaks were reported in 2011.

A majority of the cases were elderly people. The age groups above 80 years were the most common with 38% of the cases. No pregnant women and/or infants were reported with listeriosis in 2011 which is a difference from 2010 when 7 cases were reported. In 2011 slightly fewer women were reported than previous year. The counties Jämtland (incidence 2.4), Östergötland (1.4), Södermanland (1.1) and Gävleborg (1.1) had the highest incidences in 2011.

Listeriosis is most often a domestic infection. During 2011, 51 cases were reported with Sweden as country of infection. One case was infected abroad and 4 cases had missing information about country of infection.

In 2011 typing routines for human isolates of *Listeria* were changed. A new molecular typing method was implemented in 2011. The new method is more sensitive than the one previously used which gave the result serotype 1 or 4. In 2011 the distribution was as follows: molecular serotype IIa (64 %), IVb (22 %), IIc (8 %) och IIb (6 %).

Figure 4. Notified incidence (per 100,000) of human listeriosis in Sweden 1997-2011.



## DISCUSSION

An increasing trend of reported human cases of listeriosis is seen in several European countries, Sweden included, which has led to study projects and baseline studies across Europe. The reasons for this increase remain unclear and should be elucidated because of the severity of the infection. The increase in the notified incidence may be attributed to changes in consumer habits, in the food chain or in legislative changes. In 2010 and 2011, however, the number of cases decreased in Sweden but it is still too early to predict a trend shift from the overall increasing trend.

The case-fatality rate of listeriosis is high. Almost one fourth of the patients died within three months but since most of them suffered from severe underlying diseases the impact of listeriosis is difficult to estimate. A strong decrease in number of reported pregnant women and/or infants was seen in 2011 compared to the previous year.

The microbiological criteria on *L. monocytogenes*, set in 2005 decide the standard the industry has to achieve for their products to be considered safe for consumers. The results from the 2010 survey showed that the fish industry still has problems with *L. monocytogenes* and the results indicate this to be a problem primarily for packaged cold-smoked and gravad fish. Due to the successful nationwide project in 2010 where almost all isolates were serotyped a similar collection of human isolates will be performed every third year. In the near future a report will be put together on the subtyping results covering the isolates from food, processing plants and humans all collected during 2010. Surveillance of *L. monocytogenes* in humans and in food and food processing environment will be essential for understanding the sources for human infection and giving tools how to prevent infections.

## REFERENCES

Thisted Lambertz S, Nilsson C, Brådenmark A, Sylvén S, Johansson A, Jansson L-M and M. Lindblad. "Prevalence and level of *L. monocytogenes* in three categories of RTE foods in Sweden 2010". submitted.

Parihar VS, Lopez-Valladares G, Danielsson-Tham ML, Peiris I, Helmersson S, Unemo M, Andersson B, Arneborn M, Bannerman E, Barbuddhe S, Bille J, Hajdu L, Jacquet C, Johansson C, Löfdahl M, Möllerberg G, Ringberg H, Rocourt J, Tjernberg I, Ursing J, Henriques-Normark B, Tham W. Characterization of human invasive isolates of *Listeria monocytogenes* in Sweden 1986–2007. *Foodborne Pathogens and Dis.*, 2008; 5; 6.

Carrique-Mas J, Hökeberg I, Andersson Y, Arneborn M, Tham W, Danielsson-Tham ML, Osterman B, Leffler M, Steen M, Eriksson E, Hedin G, Giesecke J. Febrile gastroenteritis after eating on-farm manufactured fresh cheese – an outbreak of listeriosis? *Epidemiol Infect.* 2003;130(1):79-86.

# Maedi-Visna

## BACKGROUND

The causative agent of maedi-visna (MV) is a lentivirus in the Retrovirus family. Transmission between animals occurs most commonly via the oral route (e.g. via milk), but may also occur via inhalation of infected aerosol droplets. The incubation period is long indicated by the name lenti meaning slow.

In Sweden MV was diagnosed in 1974 by post mortem examination at slaughter. A serological screening performed at seven Swedish abattoirs in 1989 demonstrated 8.2% seropositive flocks. A voluntary control program for MV was launched by the Swedish Animal Health Service in 1993. The conditions applying to this program are stated in the Swedish legislation (SJVFS 1999:25). A second MV program for sheep and goats that is not regulated within the Swedish legislation and does not require the same obligations from the farmers, was started by the Swedish Animal Health Service at the end of 2005. The two MV programs are running in parallel.

Since 1993 more than 600 flocks have been diagnosed with M/V of which 270 flocks with close to 15,000 sheep have been culled and in a majority of the flocks measures to eliminate the infection have been taken.

## DISEASE

In most cases clinical signs such as wasting, respiratory distress, arthritis and staggering, do not occur until the sheep are 3-4 years old or more. However, it can be an underpinning cause of other infection manifestations.

## LEGISLATION

Decision 1991/0068/EEC encompasses MV. MV is included in the Swedish legislation regarding notifiable diseases (SJVFS 2002:16 with amendments) stating that the disease shall be reported when it has been diagnosed.

## SURVEILLANCE

The initial goal of the control program was to create a pool of MV free breeding stock. This goal was reached some years ago, and in the second phase the aim is to eradicate MV from the Swedish sheep population.

Farmers joining the initial program sign a contract where they agree that all animals have to be individually identified and the farmers have to keep a record of the flock. Blood samples are collected from all sheep older than 12 months of age. If the serology is negative, the flock gets an M1-status. 12-16 months later, a second sampling of all individuals older than 24 months is performed and if all samples are negative for M/V antibodies M2-status is granted. This procedure is repeated 12-16 months later and a negative result grants M3-status, which means that the flock is declared free of M/V. Farmers within the program are only allowed to bring in animals from flocks with the same or higher M/V status. In flocks where antibodies are detected, depending on the prevalence of positive animals, either a whole herd cull or eradication measures including selective slaughter is performed.

At the end of 2011, 3,270 flocks with a total of 127,300 sheep were enrolled in the initial program. During the year 22,000 samples were analyzed within the programs.

Diagnostic testing was performed at the National Veterinary Institute (SVA). Sera were analyzed using an AGID-test (agar gel immune diffusion) for which the antigen was purchased from VLA or with an ELISA-test (Synbiotic's Elitest MVV/CAEV).

## RESULTS

MV antibodies were detected in 130 sheep. The number of flocks with M3-status (i.e. declared MV free) was 2,836 at the end of the year, with a total of 111,519 sheep.

## DISCUSSION

It is estimated that more than 200,000 sheep are controlled in the two programs, which is more than 80% of the Swedish sheep population. There is still, however, a significant number of small flocks that is not included in the control programs. Efforts to contact and enroll new flocks will continue. The proportion of MV positive among the not affiliated flocks is decreasing.

# Nephropathia epidemica



## BACKGROUND

Nephropathia epidemica (NE) is caused by Puumala virus, a member of Hantavirus genus in the *Bunyaviridae* family. Hantaviruses are the cause of rodent-borne haemorrhagic fevers with renal syndrome (HFRS) and hantavirus pulmonary syndrome (HPS). Puumala virus is likely the most prevalent hantavirus in Europe. The virus is excreted from its natural reservoir, the bank vole by saliva, urine and faeces. Puumala virus can remain infectious in bank vole cage beddings for two weeks. Transmission to humans often occurs in an aerosolized form. Humans may be exposed to virus aerosols during occupational or recreational activities, such as working with hay, cleaning barns or summer cottages, cutting wood and entering buildings contaminated with rodent excretions.

NE was first described by two Swedish physicians independently in 1934. The linkage to its natural reservoir, the bank vole, was suggested many years later. The virus was first isolated in 1982 in Puumala, a municipality in south-eastern Finland.

In Sweden, between 100 and 600 cases are reported each season with a considerable inter-annual variation coupled to the 3-4 year population cycle of the bank vole. During the seasons 2006-2007 and 2007-2008 the annual number of notified cases rose to 1,400.

## DISEASE

### Animals

In bank vole, the infection is as far as we understand subclinical.

### Humans

The clinical picture is characterized by a sudden onset with high fever, headache, backache and abdominal pain. The symptoms range from subclinical to renal failure requiring intensive care and dialysis, but fatal cases are rare. The incubation period varies from 2 to 6 weeks.

## LEGISLATION

### Animals

Hantaviruses are not notifiable in animals.

### Humans

Nephropathia epidemica has been notifiable since 1989 according to the Communicable Disease Act (SFS 2004:168).

## SURVEILLANCE

### Animals

There is no surveillance in animals.

### Humans

The surveillance in humans is passive.

## RESULTS

### Humans

In 2011, 350 nephropathia epidemica cases were reported, which is a 16 % decrease from the number in 2010 and thus reflecting the reduced number of bank voles during the later half of the year (Figure 5).

Most reported NE cases were in the age between 40 and 70 years. The majority of reported cases were men (60%), except from in the age group 25-29

years, where the women dominated. The reason for the difference between age groups and genders is not clear.

Almost all cases acquired their infection in Sweden. One case reported having been infected in Finland, where NE is common as well.

Like in previous years, most of the cases (76%) were reported from the four northernmost counties in Sweden. Västerbotten county had the highest incidence with 36 cases per 100,000 inhabitants.

Following a peak in the number of NE reports in late 2010 and early 2011, the incidence decreased to subsequently stabilize at a relatively consistent level with on average 28 cases reported each month. The characteristic increase in number of cases, which is usually seen in autumn, when the voles are starting to find their way indoors to human habitations when it gets colder outside, did not occur, probably because of the reduction of the bank vole population.

#### DISCUSSION

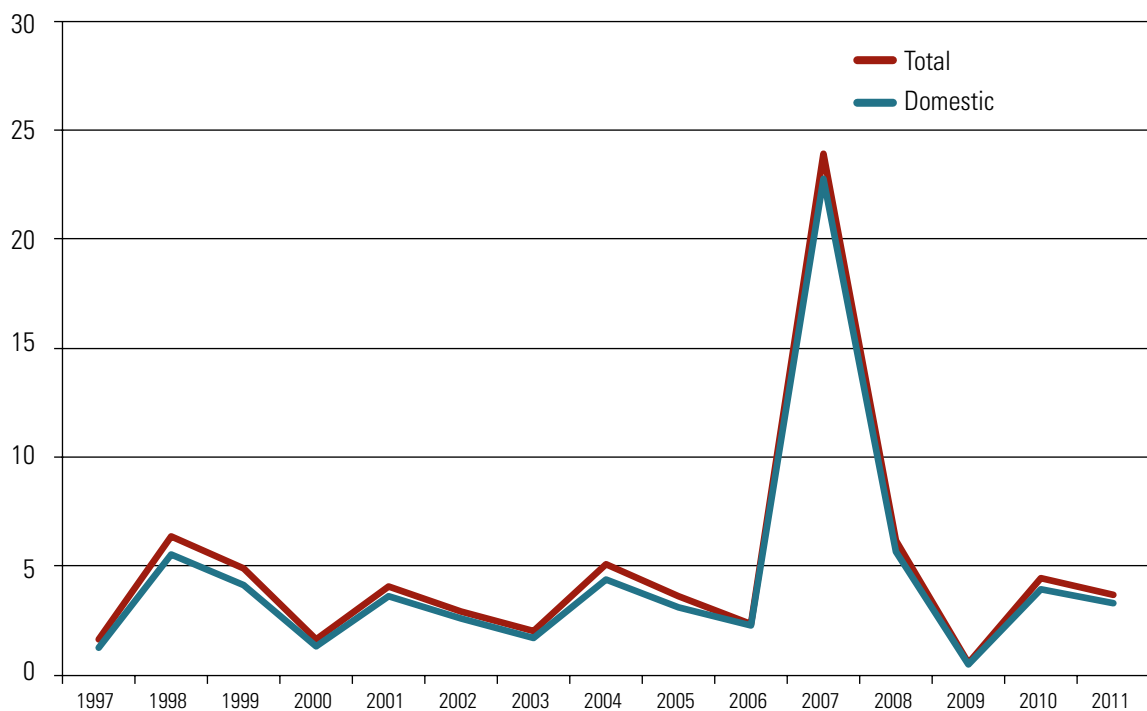
Peaks and downs in the bank vole population coincide with increased and decreased numbers respectively of human cases of Puumala virus infections which was evident during the last year. In late 2011, the bank vole population was in the declining phase of its cycle resulting in a decrease of human NE cases. Except from the 3-4 year natural population cycle, variations in the climatic conditions also have an impact on rodent populations.

#### REFERENCES

Evander, M and Ahlm, C. Milder winters in northern Scandinavia may contribute to larger outbreaks of haemorrhagic fever virus. *Global Health Action* 2009.

Report on trends and sources of zoonoses, Sweden 2009

Figure 5. Notified incidence (per 100,000) of human Nephropathia epidemica in Sweden 1997-2011.





# Paratuberculosis

## BACKGROUND

Paratuberculosis is a common disease in most countries in the world, whilst the Swedish situation with an extremely low prevalence, is unique. However, sporadic cases have occurred in beef cattle, all of them connected directly or indirectly to imported animals, most recently in 2005. Paratuberculosis has never been detected in dairy cattle, other ruminant species or wildlife in Sweden. The overall purpose of the surveillance and the control program in beef herds is to document freedom from bovine paratuberculosis and to prevent possible spread by early detection of the infection.

## Previous active surveillances

- Tracings and several screenings in cattle after detection of a positive beef cow in 1993.
- Annual screening of 200 dairy herds in the years of 2000, 2003 and 2005.
- Since 2004 sampling of all ruminants above one year of age submitted for necropsy for *Mycobacterium avium* subsp. *paratuberculosis* (MAP) by culture.
- Screening of sheep herds since 1993.
- In 2007-2009 screening of beef herds with importation of animals during 1990-2005.

## DISEASE

Paratuberculosis, also called Johne's disease, is an intestinal infection in ruminants caused by *Mycobacterium avium* subsp. *paratuberculosis* (MAP). MAP can be excreted in the faeces of an infected animal and the transmission route is faecal to oral. It causes chronic diarrhoea and emaciation resulting in suffering and death. The disease causes great economic losses due to reduced milk production and reduced lifetime of affected animals. The incubation period is several years, in areas with endemic infection clinical disease is most commonly seen at the age of 2-5 years. There is no reliable method to detect the infection during the incubation period.

The zoonotic potential of MAP cannot be ignored and there are ongoing discussions about MAP as one possible cause for Crohn's disease in humans. In countries with high prevalence of the disease, MAP has been demonstrated to occur in animal products such as milk and meat by which humans can be exposed to the bacteria.

## LEGISLATION

Paratuberculosis (Johne's disease) is included in the Swedish Act of Epizootic diseases since 1952 (SFS 1999:657 with amendments). Vaccination is according to this law prohibited and notification of the infection is mandatory based on clinical suspicion. Whole-herd slaughter is performed if MAP is detected in a herd.

## SURVEILLANCE

### Diagnostic tests

In 2011 all samples from surveillance were cultured. After pre-treatment with HPC and double incubation, samples were cultured on modified Löwenstein-Jensen medium supplemented with mycobactin and on Herrolds Egg Yolk medium for up to 4 months. Faecal samples from sheep were cultured for up to 6 months, on both modified L-J with mycobactin and modified Middlebrook 7H10 with mycobactin. Direct PCR on a new preparation from the stored sample was performed on samples within

the control program that had mould overgrowth in the culture.

Samples collected on clinical suspicion were analyzed with both direct PCR and culture. All tests for MAP were performed at the National Veterinary Institute, SVA

### Passive surveillance

Sampling and diagnostic work up is mandatory in animals of any ruminant species showing symptoms that lead to clinical suspicion of paratuberculosis. Sampling includes faecal samples from live animals and post-mortem samples from dead or culled animals. The latter include samples from the ileal wall, ileal content and ileocaecal lymph nodes as well as any macroscopic lesions in the intestines. Wildlife is sampled when MAP is suspected at necropsy.

In 2011 five clinical suspicions were raised; three cases involving yaks, one in cattle and one in a wildebeest from a zoo.

### Active surveillance

#### *Control program in beef cattle*

In the control program, the target population is beef herds that sell animals for breeding. The control program is managed by the Swedish Animal Health Service and financed by the Swedish Board of Agriculture. In total, the control program for bovine paratuberculosis encompassed 485 herds at the end of 2011 including all main breeding beef herds and a smaller number of dairy herds. The program underwent some changes in 2011 and in affiliated herds yearly faecal samples are collected from all cattle from two years of age and all purchased animals from one year of age. After three years of negative results, the faecal sampling is replaced by autopsy of all deceased or euthanized cattle on the premises where paratuberculosis cannot be excluded as a cause of culling. In 2011 the number of sampled herds within the control program was 58 with 988 samples from cattle and 188 samples from sheep.

*Post mortem examinations*

Sampling was performed on ruminants above one year of age submitted to post mortem examinations. Samples were taken from the ileal wall, ileal content and ileocaecal lymph nodes and submitted to SVA. In 2011, 373 animals were sampled (203 cattle, 155 sheep, and 15 exotic ruminants (alpaca, bison, wisent and yak)).

*Screening of sheep*

Ten older animals within 66 sheep herds were sampled during 2011. These herds were selected within the Maedi-Visna program. Another screening was performed in mixed herds with both cattle and sheep, within the control program, where 528 sheep from 20 herds were sampled.

**RESULTS**

MAP was not detected in any of the examinations carried out in 2011 (Tables 4 and 5).

**DISCUSSION**

The prevalence of MAP in Swedish ruminants remains at a very low level.

The screening of beef herds with cattle imported 1990-2005 was aiming for the highest risk group of animals for MAP in Sweden; MAP has been detected in no other breeds or species than beef cattle and all cases have been traced back to imported

animals. A new screening of beef herds that have imported live animals 2006-2011 is planned for 2012.

A previous screening of older cows at slaughterhouses, 2009-2010, was also aiming at a risk group of animals; cows older than six years with signs of weight loss, and resulted in 1,211 sampled cows.

Fallen stock is also considered a risk category for MAP and therefore all ruminants older than one year of age, submitted for post mortem examination, are sampled for MAP. In addition to the present sampling, all herds affiliated to the control program will have to send fallen stock for post mortem examination. The post mortem sampling also includes other susceptible species, like alpacas, bison and vicents which are often kept in herds with animals imported from countries where MAP is frequently occurring.

In a recent study, the probability of freedom and sensitivity of the surveillance system for MAP was estimated. Results show that, at the end of 2008, there was a high probability that the Swedish cattle population was free from or had a very low prevalence of MAP. This supports the need for continued investigations of animals being imported, as imports of susceptible species possess the greatest risk of introduction of MAP to the Swedish cattle population.

Table 4. Screening of sheep.

<b>Surveillance in sheep</b>	<b>No of sampled sheep</b>	<b>No of herds</b>
Screening of sheep (MV-program)	609	63
Directed screening of sheep in cattleherds within the program	528	20
Control program	188	12
Post mortem examinations	155	137

Table 5. Screening of cattle.

<b>Surveillance in cattle</b>	<b>No of sampled cattle</b>	<b>No of herds</b>
Control program	988	58
Post mortem examinations	203	177
Post mortem examinations of exotic ruminants	15	9





#### REFERENCES

Frössling, J, H. Wahlström, E. Ågren, A. Cameron, A. Lindberg, S. Sternberg-Lewerin. Surveillance system sensitivities and probability of freedom from *Mycobacterium avium* subsp paratuberculosis infection in Swedish cattle. Submitted manuscript under revision.

Sternberg Lewerin, S., E Agren, J Frossling, G Bolske, A Holmstrom, A Lindberg, E Szanto, D Viske. Control of paratuberculosis in Sweden. In the proceedings of: 9th ICP, Japan, Nov 2007.

Rockström, U. 2011. Slutrapport; Undersökning avseende paratuberkulos i nötkreatursbesättningar som varit sista besättning till djur, vilka importerats till Sverige under 1990 till 2005. Jordbruksverkets diariernr 33-4861/11.

# Porcine Reproductive and Respiratory Syndrome

## BACKGROUND

Porcine Reproductive and Respiratory Syndrome (PRRS) is caused by an enveloped RNA-virus belonging to the family Arteriviridae and the disease affects domestic swine. PRRS is a highly contagious disease transmitted between swine both through direct and indirect contact.

Seropositive feral pigs and wild boars have been described but there is no evidence of wild boar being a reservoir for PRRS. The disease was first described in USA in 1987 and the virus was subsequently identified in 1991. Since then PRRS has spread to be endemic in most of the swine populations of the world and is now considered to be one of the most economically important viral diseases in swine production. In 2006, an atypical variant of PRRS virus was reported from Asia. This variant causes more severe clinical signs and higher mortality than the previously described variants of the virus.

In 1998 the Swedish Animal Health Service launched a surveillance program in which the Animal Health Service does the sampling and the National Veterinary Institute performs the analyses. The first case of PRRS in Sweden was confirmed in July 2007. Until then Sweden was one of few countries that declared themselves free of PRRS. The outbreak was detected through routine sampling within the surveillance program. Since the disease was not widespread at the time of detection a decision was made to control the outbreak through a modified stamping out procedure. The actions taken to eradicate the disease proved to be effective and following extensive surveillance sampling during the fall of 2007 Sweden was declared free from the disease with high probability in the beginning of 2008. Despite extensive investigation the source of the outbreak could not be established.

After the outbreak in 2007 the surveillance program has been revised in order to enable an even earlier detection of a new introduction of the disease.

## DISEASE

As indicated by the name, infection with PRRS virus causes varying clinical signs depending on age of the infected animals. The incubation period is 2-7 days (usually 2-3 days) and in adult swine the clinical signs are usually mild, consisting of increased body temperature and inappetence for a few days. The devastating effect of PRRS infection in this category of animals is that it might lead to reproductive failure including late abortions, mummified fetuses, small litters and increased frequency of non pregnant sows. In fattening pigs the infection mainly causes respiratory signs.

The new atypical variant of PRRS may cause high fever, discolouration of the skin and mortality rates up to 100% in all age groups.

## LEGISLATION

The disease was included in the Swedish Act of Epizootic Diseases in 1999 (SFS 1999:657 with amendments) meaning that any suspicion of PRRS is compulsory notifiable and notification will lead to investigation.

## SURVEILLANCE

The purpose of the surveillance is to document freedom from PRRS and to detect introduction of the disease before it has been widely spread in the population. Both sampling for detection of virus genome and antibodies against PRRS virus are used in the surveillance. To detect antibodies against PRRS virus a commercial ELISA-method (HerdChek® PRRS X3 Antibody ELISA, Idexx Laboratories) is used and presence of virus genome is analyzed using a polymerase chain reaction (PCR)-method. Samples positive for PRRS virus antibodies in the ELISA-test are analyzed in an immunoperoxidase monolayer assay (IPMA) for confirmation.



#### Passive surveillance

As PRRS is notifiable on clinical suspicion for both veterinarians and farmers, cases with suspect clinical signs will be investigated following notification to the Swedish Board of Agriculture. The investigation includes, in addition to restrictions on the farm during investigation, sampling of sick or dead animals and examination of the herd for presence of clinical signs and analyses of production results.

Ongoing testing of animals for export and at breeding centers adds to the passive disease surveillance.

#### Active surveillance

The revised active surveillance program implemented in 2007 comprises sampling in all Swedish nucleus herds, multiplying herds and sow pools twice a year and randomly selected production herds at slaughter once a year. In nucleus herds, multiplying herds and sow pools eight samples per herd are analyzed at each sampling occasion and at slaughter three samples per herd are analyzed.

In addition, analyses for PRRS virus genome with PCR are included in the active surveillance of aborted fetuses from sows.

### RESULTS

#### Passive surveillance

Thirteen investigations following clinical suspicion of PRRS were undertaken during 2011. In the majority of these herds, reproductive failure was the main clinical manifestation and other diseases included in the epizootic act were investigated in parallel to PRRS. Following sampling and testing the herds could be declared negative for PRRS.

Samples originating from pre-testing for export and at breeding centers were all negative regarding PRRS.

#### Active surveillance

In 2011, 1,240 samples from nucleus herds, multiplying herds and sow pools and 2,308 samples originating from approximately 770 herds sampled at slaughter were analyzed. All samples were tested for the presence of antibodies to PRRS and in none of them antibodies to PRRSV were found.

Within the surveillance of aborted fetuses, 34 fetuses from 22 herds were examined for PRRS virus genome and all samples were negative regarding PRRS.

### DISCUSSION

Following the outbreak of PRRS in 2007, the active surveillance program was further developed for an earlier detection of PRRS introduction into the country. The program was based on a calculated sample volume of approximately 7,000 samples. As the Swedish pig population has decreased during 2007-2011 and as the pig production in Sweden is considerably changing, an evaluation of the program will be performed during 2012 to, if necessary, adjust it to the new conditions.

### REFERENCES

Frössling J, Ågren ECC, Eliasson-Selling L, Sternberg Lewerin S, 2009. Probability of freedom from disease after the first detection and eradication of PRRS in Sweden: Scenario-tree modeling of the surveillance system. Preventive Veterinary Medicine 91(2-4),137-45.

# Psittacosis

## BACKGROUND

Psittacosis is caused by *Chlamydophila psittaci*, an intracellular bacterium. In 1879, psittacosis was described for the first time when an outbreak of pneumonia associated with exposure to tropical pet birds was detected among Swiss patients. The organism was identified in the 1930's. Since then, outbreaks have been described worldwide.

The main reservoir is in birds and the organism is excreted in faeces and nasal discharges. Birds may become carriers of the organism and shed it for years without any symptoms. People acquire the infection mainly via inhalation of contaminated dust or through contact with infected birds. In birds, the infection is transmitted via contact or via ectoparasites or via contaminated equipment. *C. psittaci* may persist in dry faecal secrete for months.

Control of psittacosis is very difficult. As the organism exists in both domestic and wild birds, eradication is impossible.

## DISEASE

### Animals

Birds commonly develop symptoms when stressed or immune system is depressed. Symptoms in birds range from an asymptomatic infection to conjunctivitis, sneezing, pneumonia and generalized infection. Adult birds recover from the infection whereas mortality can be up to 90% among young birds.

### Humans

In humans the symptoms often include fever, headache, rash, myalgia, chills and upper or lower respiratory tract infection. The disease is usually mild or moderate, but can be severe especially in untreated elderly persons. The incubation period is usually between 5 and 14 days.

## LEGISLATION

### Animals

*C. psittaci* is notifiable in animals according to (SJVFS 2002:16 with amendments).

### Humans

Psittacosis has been a notifiable disease since 1969 according to the Communicable Disease Act (SFS 2004:168).

## SURVEILLANCE

### Animals

No active surveillance exists. Notifications are mainly based on detection of the organism by PCR.

### Humans

The surveillance in humans is passive.

For laboratory verification of the infection serology and PCR are the methods used.

## RESULTS

### Animals

No cases were reported in animals in 2011.

### Humans

In 2011, five cases of psittacosis were reported and all of them were infected in Sweden. All the cases were in the age group 40 to 80 years old. Four cases were men and one was a woman. In the case reports in which a probable way of transmission was stated, all of the infected people had been feeding birds.

## DISCUSSION

In the 1980'ies around 100 human cases were reported each year. During the last decade, between two and 24 cases have been notified yearly. There is no obvious explanation to this decrease in number of cases, but one possible cause could be that there is less sampling of ill persons. Surveys performed in other countries suggest that the number of human cases of psittacosis is underestimated. Detection methods are not sensitive enough.

At present, *C. psittaci* does not occur in Swedish poultry. The organism is occasionally reported in cage birds but psittacosis is considered common in both cage birds and wild birds.

# Q fever

## BACKGROUND

Q fever is a zoonotic disease caused by the bacterium *Coxiella burnetii*. Because of its tolerance to heat, dryness and many disinfectants, the organism is difficult to eradicate. Cattle, sheep and goats are considered to be the main reservoirs of the organism, but pets such as dogs and cats may also become infected. The agent is shed through several routes, such as milk, fetal and vaginal fluids, feces, urine and semen. *C. burnetii* has also been isolated from ticks.

Transmission to humans is mainly considered to be through inhalation of contaminated aerosols and dust. Therefore, contact with dusty animal products and -environments, such as wool, hay and bedding material may pose a risk. Also, consumption of unpasteurized raw milk may constitute a risk to susceptible individuals. In humans, immunosuppression, predisposing valvular heart disease and pregnancy may increase susceptibility to Q fever.

Larger outbreaks of Q fever, when reported, are principally always associated with small ruminants, whereas cattle more appear to be a possible source of sporadic cases. In many countries, Q fever is seen as an occupational hazard for professionals in contact with domestic ruminants and their environments, such as farmers, veterinarians and abattoir workers.

The presence of *C. burnetii* in domestic animal populations in Sweden is known since the early 1990's, when the bacterium was first isolated from a sheep placenta in a herd on the isle of Gotland. In 1993, a survey on Swedish sheep and cattle showed a low seroprevalence (0.3% in sheep (n=1001) and 1.3% in cattle (n=784). In 2008/2009, a national survey on dairy cattle herds was performed showing that 8% of the herds were antibody positive in bulk milk. There were large regional differences, with highest prevalence on the isles of Gotland and Öland (59 and 35%, respectively). In 2010, national surveys in dairy goats and sheep showed that a very low prevalence of antibodies; for sheep measured in pooled serum samples 0.6% (n=518 sheep herds) and for goats measured in bulk milk 1.7% (n=58 herds). In addition, the goat samples were also analyzed for detection of the agent, and *C. burnetii* was not detected in bulk milk from any of the investigated dairy goat herds

There have been difficulties associated with serological diagnosis of Q fever in small ruminants and recent suggestions that the use of assays based on ruminant antigen rather than tick antigen may be more sensitive. However, this was not the fact under Swedish conditions as evaluated in 2010, where the two tests performed in a similar manner in sheep and goats, and where the kit with ruminant antigen was, if anything, less sensitive in Swedish cattle.

In humans, only two domestic cases were reported in the 1980's and 90's. During the same period, a serosurvey in humans identified 28% of sheep farmers and 13% of veterinarians to be antibody positive, indicating a larger extent of the exposure. However, a prospective study on cases of endocarditis showed that only one of 329 patients had antibodies to *C. burnetii* indicating that the chronic Q fever endocarditis is rare. Since Q-fever became notifiable in humans in 2004, one to three cases have been reported annually until 2008, when an increase could be observed. Only one case was classified as domestic during the period 2004-2009. In 2010, the epidemiological situation changed as eight of the totally 11 reported cases claimed having been infected in Sweden. All these domestic cases were linked to a farm in southern Sweden, which was included in a national survey on dairy herds and where the bulk milk from the cows was shown to be antibody positive for *C. burnetii*. As for several other diseases, the incidence of the disease in humans seems to be underestimated.

## DISEASE

### Animals

Q fever in animals is usually asymptomatic but can also lead to reproductive failures such as abortions or still-/weakborn calves. In herds where the agent has been proven to be present it should be ascertained whether any reproductive problems are due to Q fever or if there are, in fact, other causes.

### Humans

In humans the infection can vary from asymptomatic or flu-like illness to acute pneumonia. Liver complications and abortions occur. Most patients recover but some may develop a chronic illness. Incubation period varies depending on the number of organisms inhaled but is usually 2-3 weeks.

### LEGISLATION

#### Animals

Q fever is a notifiable disease according to (SJVFS 2002:16 with amendments). Notification of a primary case of Q fever in animals is based on detection of the agent or increased antibody levels in paired samples.

#### Humans

Q-fever has been notifiable according to the Communicable Disease Act since 2004 (SFS 2004:168).

### SURVEILLANCE

#### Animals

In 2010/2011 a regional bulk milk survey of antibodies to *C. burnetii* was carried out on the isle of Gotland, involving 114 dairy cattle herds (approximately 50% of all dairy herds on the island). In total there were four sampling occasions; September 2010, January, June and October 2011. The samples were investigated for antibodies by an indirect ELISA (CHEKIT Q-fever, Idexx) and for detection of the agent by RT-PCR (in-house protocol).

A national survey for detection of *C. burnetii* in 80 sheep herds was conducted. Ten sheep in each herd were sampled in conjunction with lambing using vaginal swabs. The samples were then pooled by herd at the laboratory and analysed by RT-PCR (in-house protocol).

A survey was carried out for investigating the *C. burnetii* status of Swedish elks. Organs from 59 elks were sampled in conjunction to hunting and analyzed for antibodies against *C. burnetii* by complement fixation test. The selected hunting areas were located in southern Sweden.

For export testing, serum samples from 22 bulls and 23 alpacas were analyzed for the presence of antibodies by an indirect ELISA (CHEKIT Q-fever) and from 12 bulls by complement fixation test. Eight serum samples from cattle in two herds were investigated for presence of antibodies due to clinical investigation by indirect ELISA test (CHEKIT Q-fever). In addition, eight samples from sheep in two herds were investigated for detection of the agent by RT-PCR (in-house protocol) in conjunction with surveillance for *Brucella ssp.* in aborted material.

#### Humans

The surveillance in humans is passive.

For laboratory verification of the infection serology and PCR are the methods used.

### RESULTS

#### Animals

For the regional bulk milk survey on the isle of Gotland with four sampling occasions, the prevalence of antibody positive dairy cattle herds varied from 56% (95% CI 51-61%) to 65% (95% CI 56-74), and the prevalence of agent positive herds varied from 46% (95% CI 47-66%) to 59% (95% CI 50-68%). The incidence for herds at risk (negative at previous sampling) varied between 16-21% for antibodies and 22-28% for the agent, the new infections occurred in all seasons. In total, 453 bulk milk samples were investigated for the presence of antibodies and the agent; 52% were positive and 34% negative in both analyzes 9% antibody negative and agent positive, and 5% antibody negative and agent positive.

All 80 herds sampled for the agent in the national sheep survey were negative. The samples submitted for export testing, the clinical suspected cattle and the samples of aborted material were all negative for *C. burnetii*.

Antibodies to *C. burnetii* were not detected in any of the sampled elks.

#### Humans

Since the 1980s, there have, except from in 2010, only been occasional domestically acquired Q fever cases reported. Most reported cases have been infected abroad, mainly in the Mediterranean countries.

In 2011, five Q fever cases were reported. All of them were infected abroad, three in Spain, one in Albania and one in Afghanistan. All cases were men in their thirties to seventies. During the time period when Q fever has been a notifiable disease, only about 20% of the reported cases have been women. A similar difference in gender distribution has been described from other countries, but the cause of it is not clear.

## DISCUSSION

In 2011, the serological survey in sheep from 2010 was followed up by a survey based on vaginal swab sampling aimed at detection of the agent by RT-PCR. The study population was a subset of the herds included in the national serum survey that was performed in 2010, including two out of the three antibody positive herds. The results confirmed that *C. burnetii* is a rare pathogen in Swedish sheep. Still, it is known from older studies that Swedish sheep farmers have a higher prevalence of antibodies to *C. burnetii* than both veterinarians and control populations. This suggests that sheep could be a source of infection to humans in Sweden. However, it is not known from those studies to what extent farmers were also exposed to cattle, where the prevalence is known to be high in some areas. The results of the elk study suggests that *C. burnetii* has not spread to wild ruminants, these were sampled in southern Sweden where the prevalence of *C. burnetii* among cattle is high. The survey in Gotland dairy cattle confirmed the results from 2008/2009, and shows that this region has a high prevalence of cattle herds exposed to the agent; new infected herds were observed at all seasons and the prevalence was high regarding both antibodies and agent at all sampling occasions.

Determination of antibody status in bulk milk was shown to have a high correlation (86%) with the presence/absence of agent, and analysis of antibodies can therefore be useful tool for identifying infected herds in epidemiological research and surveillance.



## REFERENCES

ECDC. Technical report: Risk assessment on Q fever. [46 pp] doi:10.2900/28860. Available online: [http://www.ecdc.europa.eu/en/publications/Publications/1005\\_TER\\_Risk\\_Assessment\\_Qfever.pdf](http://www.ecdc.europa.eu/en/publications/Publications/1005_TER_Risk_Assessment_Qfever.pdf)

EFSA Panel on Animal Health and Welfare (AHAW); Scientific Opinion on Q Fever. EFSA Journal 2010; 8(5):1595. [114 pp.]. doi:10.2903/j.efsa.2010.1595. Available online: [www.efsa.europa.eu](http://www.efsa.europa.eu)

# Rabies

## BACKGROUND

Rabies is caused by a rhabdovirus belonging to a family of Lyssaviruses. Rabies can infect all warm-blooded animals. Rabies occurs worldwide with some free areas. Rabies is transmitted through contact with saliva, typically via animal bites. Most human cases are caused by infected dog bites. The reservoir animal species of rabies in endemic countries are wild carnivores or stray dogs. In Europe the reservoir species are red fox and raccoon dogs. Bats in Europe may carry another type of rabies virus called European Bat Lyssa virus (EBLV), but never classical rabies. Since 1886 Sweden has been free from animal rabies. EBLV has never been isolated from bats in Sweden.

## DISEASE

Humans and animals

Rabies virus infects the central nervous system of humans and mammals. Early symptoms of rabies are nonspecific, consisting of fever, headache, and general malaise. As the disease progresses, neurological symptoms appear and may include insomnia, anxiety, confusion, slight or partial paralysis, excitation, hallucinations, agitation, hypersalivation and difficulty swallowing. The incubation period of rabies is usually 3-6 weeks, but may vary from five days to one year.

Not much is known about symptoms in EBLV infected bats. They may express weight loss, disorientation, lack of coordination and muscle spasms and aggression, but some infected bats may be normal in behaviour.

## LEGISLATION

Animals

Rabies is included in the Swedish Act of Epizootic diseases (SFS 1999:657 with amendments) and is notifiable on suspicion. If rabies is suspected or confirmed measures will be taken to combat the disease and to prevent further spread.

To prevent the introduction of rabies, dogs and cats have to be rabies vaccinated before entering Sweden. In addition, depending on the country of origin, some must have their antibody titre tested. The rules are set in the EU Regulation 998/2003.

Humans

Rabies in humans is notifiable according to the Communicable Disease Act (SFS 2004:168).

## SURVEILLANCE

Animals

Since 1998, a passive surveillance program has been in place where dead bats have been examined for the presence of rabies virus. Annual information about the survey has been sent to different interested parties with an appeal to send in bats and with instructions how to handle the dead bats to reduce the risk of rabies infection. In addition, since 2008 an active surveillance program has been performed in Sweden.

Passive surveillance

During 2011, four cats, three dogs, one cattle, one red fox and one ferret were examined for rabies due to clinical suspicion. The diagnostic method used was based on the detection of antigens in brain tissue by use of a fluorescent antibody test, FAT.

Sixtyfive dead or wounded and euthanized bats were sent to the National Veterinary Institute (SVA) for rabies examination (Map 7). The contributors were mostly private persons. The diagnostic method used was FAT. Of these, 28 bats were in no condition to be examined for rabies, mostly due to decomposition. The bats were sent to The Swedish Museum of Natural History, Stockholm, to determine the species.

Active surveillance

72 Daubenton's bats (*Myotis daubentonii*) and 18 Nathusius's Pipistrelle (*Pipistrellus nathusii*) were caught in the County of Uppsala by using mist nets. Blood samples and oral swabs were taken and the species and age were determined. After sampling the bats were released.

For serology the FAVN-method with EBLV-1 virus was used. The swabs were analyzed by real-time PCR for the detection of EBLV 1 and 2 and classical rabiesvirus (RBV).

Humans

The surveillance in humans is passive.





## RESULTS

### Animals

All animals tested negative for rabies.

### Humans

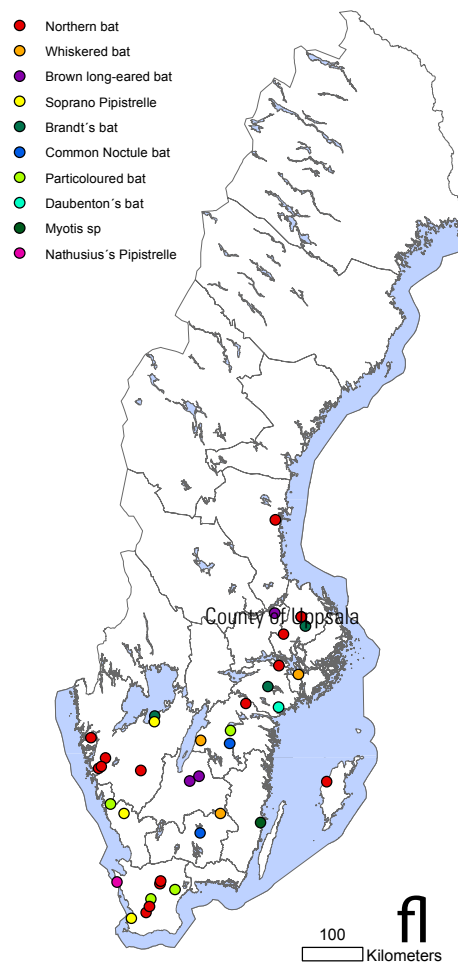
No human cases were reported during the year.

## DISCUSSION

During the last decades, two persons have been hospitalized for rabies in Sweden. In 1974, a Swedish man fell ill after having been infected in India and in 2000 a woman fell ill after a visit in Thailand. Both patients had most probably been infected by rabid dogs. Since Sweden is free from classical rabies, the risk of acquiring the disease from Swedish animals is negligible. There has been an increasing problem with illegal importation of pets since 2004, mostly dogs. Illegally imported dogs are probably the greatest threat to the rabies free status of Sweden even though the risk of introducing rabies is rather low.

In recent years Daubenton's bats have been especially investigated for EBLV and the results with seropositivity suggest that EBLV is present in Sweden, but to a very low degree. Daubenton's bat (*Myotis daubentonii*), associated with EBLV-2 infections, is common and may be found from the south up to the county of Ångermanland in the north. Six other *Myotis* species may also be found in Sweden. The Serotine Bat (*Eptesicus serotinus*), associated with findings of EBLV-1 in Europe, is found in certain habitats in the south of Sweden. The Northern Bat (*Eptesicus Nilsonii*), which is related to the Serotine Bat, is the most common bat in Sweden, and may be found all over the country. There are 18 different species of bats in Sweden, all insectivorous belonging to the family of *Vespertilionidae*.

Map 7. Distribution of bats tested for rabies in passive surveillance during 2011.



# Salmonellosis



## BACKGROUND

Salmonellosis is one of the most important bacterial zoonoses. The genus is divided into two species: *S. enterica* and *S. bongori*. Most *Salmonella* belong to *S. enterica* subspecies *enterica*. More than 2,500 different serovars belonging to this subspecies have been described. *Salmonella* can infect reptiles, all warm-blooded animals as well as humans. Humans are infected by contaminated food products of various ranges, through contact with infected animals, via person-to-person transmission or via a contaminated environment.

A severe domestic outbreak of *S. Typhimurium* in 1953 that involved more than 9,000 people prompted the need for a control program for *Salmonella*. Since then, the strategy for control has been to prevent *Salmonella* in any part of the production chain, from feed to food of animal origin. When Sweden joined the European Union in 1995, the Swedish *Salmonella* control program was accepted.

Around 3,000-4,000 human cases of salmonellosis are reported every year to the Swedish Institute for Communicable Disease Control (SMI). A majority of these (around 80-85%) are infected abroad. The low proportion of domestic infections is unique for

Sweden compared to many other countries. Few larger outbreaks are reported and the source is more often imported food than domestic.

## DISEASE

### Animals

Infection in animals is often asymptomatic. However, *Salmonella* can cause clinical illness with symptoms of diarrhoea, abortions and fever, and lead to death. In Sweden clinical signs are frequently seen in cattle herds and horses, but only rarely in swine herds and poultry flocks.

### Humans

*Salmonella* infects the gastrointestinal tract and causes an acute gastrointestinal illness. The symptoms can range from asymptomatic and mild to severe. The incubation period is often between 1 and 3 days but can vary from 6 hours to 10 days.

Most patients recover from the illness spontaneously but sequelae such as reactive arthritis occurs in approximately 1-15% of the patients. Moreover, prolonged symptomless excretion of the pathogen is common.

## LEGISLATION

## Feed

Control of animal feed is an integrated and essential part of the control program for *Salmonella* at farm level. The feed business operator is responsible for producing *Salmonella*-free feed. Poultry feed has to be heat treated according to the legislation. The major part of cattle and swine feed is also heat treated. The control of feed is supervised by the Swedish Board of Agriculture which carries out announced and also unannounced inspections at feed mills. *Salmonella* in feed is regulated in national legislation (SJVFS 2006:81) as well as in an EU regulation (Commission Regulation (EU) No142/2011).

## Animals

Investigation is required on clinical suspicion of *Salmonella* and any finding of *Salmonella*, irrespective of serovar, is notifiable and action is taken to eliminate the infection or contamination. Vaccination is not used in Sweden. The *Salmonella* Control Program is governed by the Swedish Act on Zoonosis (SFS 1999:658) and its regulations. The aim of the program is that animals sent for slaughter and animal products should be free from *Salmonella*.

## Food

Any finding of *Salmonella* in food is notifiable and a contaminated food product is considered unfit for human consumption.

## Humans

Salmonellosis in humans is notifiable according to the Communicable Disease Act (SFS 2004:168).

## SURVEILLANCE

## Feed

In the control program for feed the emphasis is on control of feed raw materials, the heat treatment process and preventive measures regarding recontamination of heat treated feed. Also, suspected feed-borne infections are investigated.

*Surveillance of feed raw materials*

Raw materials are the most important risk factor in feed production according to previous data. In domestic legislation, feed materials are classified according to the empirical risk of being contaminated, and classified feed materials have to be tested negative for *Salmonella* contamination before being

used for feed production. All consignments of intra community traded or imported feed materials classified as a risk have to be sampled for *Salmonella* according to a sampling plan. The sampling plan is designed to detect a *Salmonella* contamination in 5% of the batch with 95% probability.

*Surveillance of feed mills*

The purpose of the surveillance is to ensure the absence of *Salmonella* in the production lines as well as in the feed mill environment. A safety management system is applied in the processing line according to HACCP (Hazard Analysis and Critical Control Points). The management system covers a number of specific GMP (Good Manufacturing Practice) requirements, according to Swedish legislation. A minimum of five samples from feed mills manufacturing compound feeding stuffs for poultry and a minimum of two samples from those manufacturing compound feeding stuffs for other food-producing animals must be collected in the processing line on a weekly basis. These samples are analyzed at SVA (using the NMKL nr 71:1999 5th edition method) and any finding of *Salmonella* is reported to the Swedish Board of Agriculture. The manufacturers take additional samples from the processing line and the feed mill environment.

## Food

Control of *Salmonella* is an important part of in-house control programs in most food enterprises in Sweden. All findings shall be reported to the competent authority. Official sampling at other food enterprises than slaughterhouses and cuttingplants is at a level above 1000 samples per year and analyzed using mainly NMKL (nr 71:1999) methods and Vidas-SLM methods.

*Surveillance at slaughterhouses and cuttingplants*

According to the Swedish *Salmonella* control program samples from intestinal lymph nodes and swabs from carcasses are taken from cattle and swine and neck skin samples from slaughtered poultry. Sampling is proportional to slaughtering capacity. Altogether approximately 24,000 samples from cattle, adult swine, fattening pigs and poultry are collected annually at slaughterhouses.

At red meat cutting plants, approximately 6,000 samples are taken annually from crushed meat and

meat scrapings and approximately 1,000 samples are taken in white meat cutting plants. The samples are analyzed by regional laboratories using the current edition of the NMKL (nr 71:1999) method, with the exception of approximately 800 samples analysed with Vidas-SLM.

#### Control in food-producing animals

##### *Control in poultry*

The program comprises a compulsory part and a voluntary part. All poultry species are included in the compulsory part, which gives the rules for obligatory sampling.

##### *Compulsory program – poultry*

All breeding flocks having more than 250 birds are tested (Table 6). Grandparents of *Gallus gallus* broilers are imported as day-old chicken. Laying hens, turkeys, geese and ducks are imported as parents. Samples consist of boot swabs taken from all parts of the house where the birds are kept. From rearing flocks two pairs of sock samples are taken and pooled into one, five pairs pooled to two are taken from production flocks.

All holdings selling eggs for consumption are sampled (Table 6). All poultry flocks having more than 500 birds, irrespective of species, are tested 1-2 weeks before slaughter. The results must be available before slaughter.

The producers pay the costs for laboratory analyses and the visits to the holdings. Only accredited laboratories are allowed to perform the analyses.

The laboratory sends the test results to the County Veterinary Officer on a quarterly basis. According to the regulations the County Veterinary Officer has to send a report on the test results of all poultry holdings to the Swedish Board of Agriculture once a year.

##### *Voluntary program – poultry*

A preventive voluntary program includes all-in all-out production, hygienic measures and certain standard of poultry houses, such as hygienic barriers between the clean and unclean part. Purchase of animals is only allowed from holdings affiliated to the voluntary program. Only heat-treated feed is allowed. The poultry houses must be cleaned and disinfected before introduction of a new flock. The broiler producer has to make an application to be accepted in the voluntary program. An official veterinarian controls the housing regularly. The producers affiliated to the voluntary program are allowed higher compensation in case of *Salmonella*. All broiler producers belonging to the Swedish Poultry Association are affiliated to the voluntary program (approximately 99% of the slaughtered broilers). The voluntary program has been in place for more than 40 years. All broiler flocks are analyzed for *Salmonella* before slaughter. Positive flocks are destroyed.

##### *Control in cattle and pig herds*

The program comprises a compulsory and a voluntary part.

Table 6. Sampling scheme for *Salmonella* in poultry.

Category of poultry	Sampling frequency	Sample type	Sampling before slaughter	Official veterinarian
Breeders in rearing	1 d, 4 weeks, 2 weeks prior to rearing or moving	2 pairs sock samples	14 d before slaughter	Once a year
Breeders in production	every 2nd week	5 pairs sock samples	14 d before slaughter	3 times under production
Layers in rearing	2 weeks prior to moving	2 pairs sock samples or 2 faecal samples of 75 g	14 d before slaughter	Once a year
Layers in production	every 15th week (start at 22-26 weeks)	2 pairs sock samples or 2 faecal samples of 75 g	14 d before slaughter	Once a year
Poultry for meat production (all species)		2 pairs sock samples or 2 faecal samples of 75 g	14 d before slaughter	Once a year

The compulsory part consists of faecal sampling annually from breeding pig herds and gilt-producing herds and twice a year from sow pools. At necropsy, all calves younger than six months are tested for *Salmonella*. *Salmonella* is tested at other post-mortem investigations if an infection is suspected on the basis of the macroscopic findings. All imported animals are sampled. On clinical suspicion, herds or single animals should be tested for *Salmonella*.

The voluntary program is a preventive hygienic program aiming at decreasing the risk of *Salmonella*. Holdings affiliated to the program get higher compensation in case of positive findings. The majority of all breeding holdings and many of the large dairy herds are affiliated to the program. In addition, affiliated holdings can apply for a commercial *Salmonella* insurance.

#### Control in other animals

Animals are tested for *Salmonella* at suspicion or trace-back. Wild animals necropsied at the SVA are tested for *Salmonella*.

All samples from animals (poultry, cattle and pigs and other animals) are analyzed using the MSRV (EN-ISO 6579:2002/A1: 2007: Amendment 1: Annex D) method.

#### Humans

*Salmonella* infection is notifiable in humans. All reported domestic cases are traced for the source of infection. All isolates sent to the Swedish Institute for Communicable Disease Control are analyzed according to the guidelines of the WHO Collaborating Centre for Reference and Research on *Salmonella*. Institute Pasteur, Paris, France Grimont, P. A. D. and Weill, F-X, 2007.

### MEASURES IN CASE OF POSITIVE FINDINGS

#### Isolates

All suspected primary isolates of *Salmonella* from non-human sources are sent to the SVA for confirmation, resistance testing, serotyping and further typing. Primary isolates of *Salmonella* from humans are sent to Swedish Institute for Communicable Disease Control for serotyping and further molecular typing.

#### Feed

Findings of *Salmonella* in intra community traded or imported feed materials and compound feeds are



reported in the Rapid Alert System for Food and Feed (RASFF). Measures are always taken when *Salmonella* is detected in feed samples. *Salmonella* positive feed materials are usually treated with organic acids. After acid treatment the feed material has to be re-tested with negative result before use in feed production. Finished feed containing *Salmonella* has to be withdrawn from the market. An extended sampling is made in the production line if *Salmonella* is detected in the weekly surveillance and several measures are then undertaken. If *Salmonella* is found before heat treatment the contaminated part of the production line is thoroughly cleaned and disinfected, usually by dry cleaning, followed by disinfection. If *Salmonella* is found after heat treatment, the feed mill has to be thoroughly cleaned and disinfected. Environmental sampling must show negative results before production is resumed.

#### Animals

If *Salmonella* is suspected in an animal, a veterinarian is always obliged to take samples and implement measures to prevent further transmission. When *Salmonella* is isolated at a laboratory the laboratory has to notify the Swedish Board of Agriculture and the County Veterinary Officer. The County Veterinary Officer informs the official veterinarian at the abattoir and others needing the information before confirmation.

When *Salmonella* is confirmed on a farm, the holding is put under restrictive measures and an epi-

demiological investigation is always performed and a plan to eradicate *Salmonella* from the holding is designed. Animal movements to and from the holding are forbidden.

All *Salmonella* positive poultry flocks are euthanized irrespective of serotype. The poultry stable and all possible contaminated areas are thoroughly cleaned and disinfected. Before introduction of new birds, all environmental samples must be negative for *Salmonella*.

In pigs and cattle, a combination of stamping out of groups of animals and hygienic measures controlled by repeated sampling is usually practiced. Hygienic measures can include reducing the number of animals, control of animal feed and manure movements on the farm and reduction of *Salmonella* in the environment by cleaning and disinfection. No *Salmonella* positive animals should enter the cleaned and disinfected parts of the stable. Negatively tested animals, when considered at low risk of being infected, may be slaughtered under certain conditions with extra hygienic measures and sampling of each carcass. The restrictions are lifted when the cleaning and disinfection have been completed and *Salmonella* cannot be detected from two whole-herd samplings for culture performed four weeks apart.

If *Salmonella* is detected in companion animals advice is given to the owners. If *Salmonella* is detected in horses, the stables and or the paddocks at risk are put under restrictions and the horse is followed up.

#### Food

Food products contaminated with *Salmonella* are considered unfit for human consumption. Products released on the market will be withdrawn and contaminated products will be destroyed or sent for special treatment to eliminate the *Salmonella* bacteria.

Findings in imported consignments are reported in the RASFF-system and the consignments will be returned to the country of origin, destroyed or sent for special treatment as applicable. RASFF is also used for informing about contaminated Swedish food products released on the EU-market.

In food businesses where *Salmonella* has been detected appropriate follow-up measures will be applied such as careful cleaning and disinfection and environmental sampling will be applied.

## RESULTS

### Feed

Thirteen major feed mills produce approximately 95% of the feed for food producing animals. In the weekly surveillance of feed mills 8,735 samples were analyzed for salmonella with 52 samples (0.60 %) being positive. Fourteen serotypes were detected; *S. Typhimurium* was the most common (n=29) (Table 7).

In addition, *Salmonella* was detected in 20 (0.5%) out of 3,842 samples from feed materials of vegetable origin. The most common serotypes were *S. Senftenberg* and *S. Mbandaka* (n=6). *Salmonella* was detected in five environmental samples from domestic rapeseed processing plants. *Salmonella* was detected in 7 (0.3%) out of 2,055 samples from feed materials of animal origin and from pet food.

### Animals

#### Poultry

*Salmonella* was detected in four flocks (0.12%) of 3,411 broilers before slaughter. Of these broiler flocks, *S. Typhimurium* RDNC was detected in two and *S. Mbandaka* in one flock in routine sampling before slaughter (Table 8). In addition, *S. Be* was found in a commercial broiler flock at a holding with some hobby laying hens and turkeys.

*Salmonella* was not detected from any breeding flocks, laying hens or from turkeys. Moreover, one holding with ostriches was found infected with *S. Typhimurium* 110b and one mixed flock of breeding and fattening geese with *S. Enteritidis* 13a (Table 8).

#### Cattle and bison

In 2011, 20 cattle herds were under restrictions due to infections of *Salmonella* and at the end of the year 13 cattle herds remained under restrictive measures. Six new herds were detected during 2011 (Table 5);

- 2 cattle herds and one herd with bisons were detected by sampling of calves at post mortem examinations.
- 1 herd was sampled due to clinical disease
- 1 herd was detected by tracings from human infections
- 1 herd was sampled after the initiative of the owner

Table 7. Serotypes of *Salmonella* isolated in feed control in 2011

Serotype	Feed material of animal origin <sup>A</sup>	Pet food	Feed material of oil seed origin <sup>B</sup>	Feed material of cereal grain origin	Process control feed mills	Rape seed (environmental)
S. Agona			1			
S. Alachua					1	
S. Bietri					3	
S. Cubana			1		1	2
S. Emek					1	
S. enterica subsp.			3		1	
S. Gloucester					1	
S. Havana					4	
S. Infantis					3	
S. Lamberhurst			1			
S. Lexington			1			
S. Limete			1			
S. Livingstone				1	1	
S. Mbandaka			6			3
S. Mgulani					1	
S. Montevideo	1				1	
S. Rubislaw			1			
S. Ruiru			1			
S. Senftenberg	4		6		1	
S. Tennessee	2				5	
S. Typhimurium fagtyp 120					28	
S. Typhimurium fagtyp NST 7:1					1	
S. Weltevreden					1	
S. Worthington			1			
<b>TOTAL</b>	<b>7</b>	<b>0</b>	<b>23<sup>c</sup></b>	<b>1</b>	<b>54<sup>D</sup></b>	<b>5</b>
(total number of samples)	1,952	103	3,741	101	8,735	789

A – Meat and bone meal, fish meal, greaves, bone meal, meat meal, blood products, milk products, and poultry offal meal.

B – Derived from palm kernel, rape seed, soya bean, sunflower seed, groundnut and linseed.

C – 20 positive samples, two different serotypes in three different samples.

D – 52 positive samples, two different serotypes in two different samples.

Table 8. Results from the *Salmonella* control programme in poultry flocks 2011.

Animal species	Production type	Production stage	No. flocks	No. positives	Percentage	Serotype
Gallus gallus	Meat production	Adult Grand Parent	14	0	0,00%	
Gallus gallus	Meat production	Adult Parent	116	0	0,00%	
Gallus gallus	Meat production	Production	3411	4	0,12%	S. Be, S. Mbandaka, S. Typhimurium RDNC (n=2)
Turkeys	Meat production	Adult Parent	4	0	0,00%	
Turkeys	Meat production	Production	175	0	0,00%	
Gallus gallus	Egg production	Adult Parent	23	0	0,00%	
Gallus gallus	Egg production	Production	12	0	0,00%	
Geese	Meat production	Production	21	1	4,76%	S. Enteritidis 13a
Ducks	Meat production	Production	15	0	0,00%	

*Salmonella* was isolated from 5 of 3,372 lymph nodes analyzed (Table 9, Figure 6). *Salmonella* was not detected in the whole-herd samplings in the originating herds.

*Salmonella* was also isolated from two individual cases at necropsy, in addition to the two mentioned above, but in these two cases the organism could not be detected in the herds of origin on whole-herd sampling.

*Pigs*

In 2011, *Salmonella* was detected in four pig herds (Table 10). In one of these herds, S. Derby was detected in an extensive trace-back after isolation from beef (minced meat) and also from a lymph node from the herd. The same serotype was detected in this herd also the year before. Monophasic *Salmonella* (*S. enterica* sp. *enterica* O4:i-) was detected in one herd following trace-back after isolation of the same serotype in a herd with slaughter pigs at the

Figure 6. *Salmonella* in cattle lymph nodes sampled at major slaughterhouses.

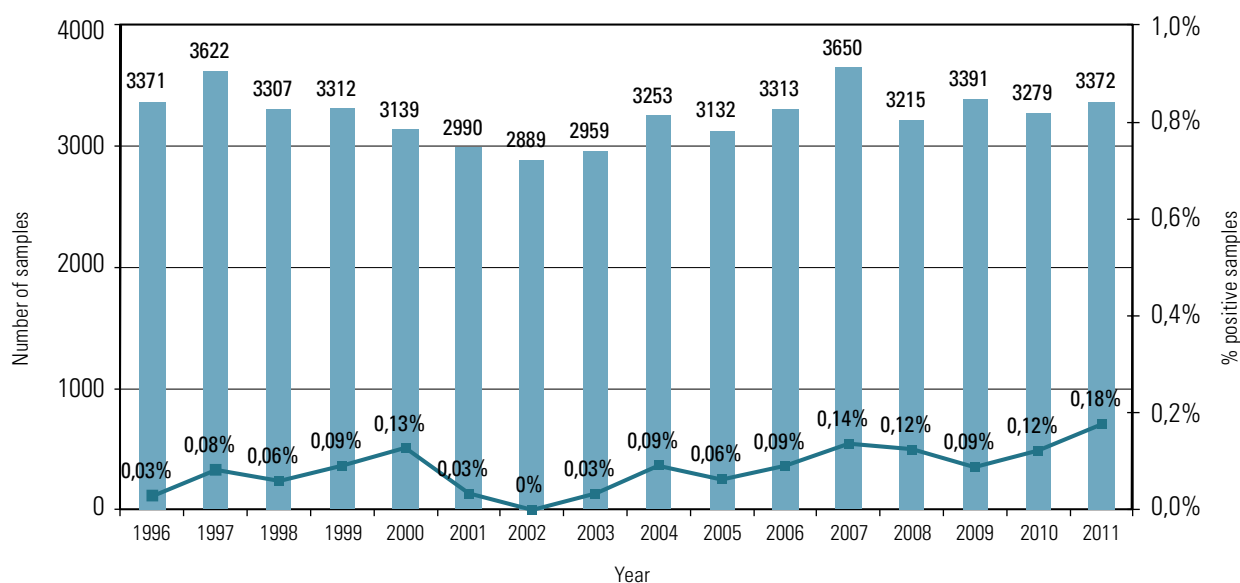




Table 9. Results from the *Salmonella* control programme at slaughterhouses and cutting plants in 2011

Animal species	Sample type	No. samples	Positive	Percentage (%)	Serotype
Cattle	Lymph node	3372	5	0,15%	<i>S. Typhimurium</i> 41 (n=2), RDNC (n=1), monophasic <i>S. Typhimurium</i> 04,5:i- (n=1)
	Carcass swab	3432	1	0,03%	<i>S. enterica</i> sp. <i>enterica</i> 6,7:d-
Breeding swine	Lymph node	2313	5	0,22%	<i>S. Infantis</i> , <i>S. Thompson</i> , <i>S. Typhimurium</i> 104, 120, 195
	Carcass swab	2336	0	0,00%	
Slaughter swine	Lymph node	3379	3	0,09%	<i>S. Derby</i> , <i>S. Typhimurium</i> 120, 195
	Carcass swab	3429	0	0,00%	
Cattle and swine	Meat scrapings	4757	0	0,00%	
Poultry	Neck skin	5968	0	0,00%	
	Meat scrapings	1095	0	0,00%	

end of 2010. In the same trace-back, another farm with *S. Typhimurium* was detected. In the fourth herd, *S. Infantis* was isolated in the whole-herd sampling following detection of the organism in a lymph node from this herd. Two additional herds were under restrictive measures due to an infection of *S. Typhimurium* detected in 2009.

*Salmonella* was detected from 5 (0.22%) of 2,313 lymph node samples taken from adult pigs (Table 9, Figure 7) and from 3 of 3,379 lymph node samples of fattening pigs (Figure 8). In two of these cases, *Salmonella* could be isolated in the following whole-herd sampling.

#### Other animals

*S. Typhimurium* was isolated from three sick foals from three holdings. The isolate of the first case could not be fully serotyped and none of the traced contact horses tested positive. The second diarrhoeic foal was hospitalized and tested positive for *S. Typhimurium* and also another horse at those premises was infected. Later the dam of the foal tested positive back at its original holding. The third foal was from a flock of 12 horses – in that case a total of 5 horses were found positive during tracing and test-

ing, all *S. Typhimurium*. One imported horse was found to have *S. Typhimurium* in an abscess. The horse did not recover and was subsequently euthanized. No other horses in the holding were infected.

As often in previous years, *Salmonella* Typhimurium was isolated from cats in January to April. In 2011, 28 cats were notified with salmonellosis (Table 11).

*Salmonella* was detected in two sheep herds, three dogs, six wild birds, one fox and further from twelve reptile pets.

#### Food

In the Swedish *Salmonella* control program, *Salmonella* was detected in one of 3,432 cattle carcasses sampled with swab technique but in none of the 5,765 swine carcass samples or 5,968 poultry neck skin samples (Table 9, Figure 9). *Salmonella* was neither isolated from any of the 5,852 samples from cutting plants.

The local health authorities reported approximately 1,200 samples for salmonella taken for other reason than the Salmonella control program. None of these 1,200 samples were found positive.

Table 10. Cattle and swine herds infected with *Salmonella* in 2011.

Primary serotype	Species	Phagetype	Restricted since	Restrictions lifted	Reason for sampling
S. Derby	swine	not relevant	2010	not	Abattoir sampling control programme
S. Dublin	cattle	not relevant	2008	2011	Trace-back
S. Dublin	cattle	not relevant	2008	not	Necropsy
S. Dublin	cattle	not relevant	2009	not	Screening survey
S. Dublin	cattle	not relevant	2011	2011	Necropsy
S. Dublin	cattle	not relevant	2011	not	Necropsy
S. Dublin	cattle	not relevant	2011	not	Clinical symptoms
S. enterica sp. enterica O 4,5,12:i:-	cattle	not relevant	2009	not	Trace-back
S. enterica sp. enterica O 4,5,12:i:-	cattle	not relevant	2009	2011	Trace-back
S. enterica sp. enterica O 4,5,12:i:-	cattle	NT	2010	2011	Necropsy
S. enterica sp. enterica O4:i:-	swine	not relevant	2011	not	Trace-back
S. Infantis	swine	not relevant	2011	not	Abattoir sampling control programme
S. Reading	cattle	not relevant	2007	2011	Abattoir sampling control programme
S. Reading	cattle	not relevant	2008	2011	Clinical symptoms
S. Reading	cattle	not relevant	2009	not	Human infection
S. Reading	cattle, swine	not relevant	2010	not	Clinical symptoms
S. Typhimurium	bison, cattle	41	2011	not	Necropsy
S. Typhimurium	cattle	120	2010	not	Human infection
S. Typhimurium	cattle	120	2011	not	Human infection
S. Typhimurium	cattle	146	2010	not	Human infection
S. Typhimurium	swine	NT	2011	2011	Trace-back
S. Typhimurium	cattle	RDNC	2010	not	Human infection
S. Typhimurium	cattle	RDNC	2011	not	Initiative of the farmer
S. Typhimurium	swine	120	2009	not	Abattoir sampling control programme
S. Typhimurium	swine	120	2009	not	Trace-back

NT= non typable

RDNC=reacts but does not conform

Figure 7. *Salmonella* in lymph nodes of adult pigs.

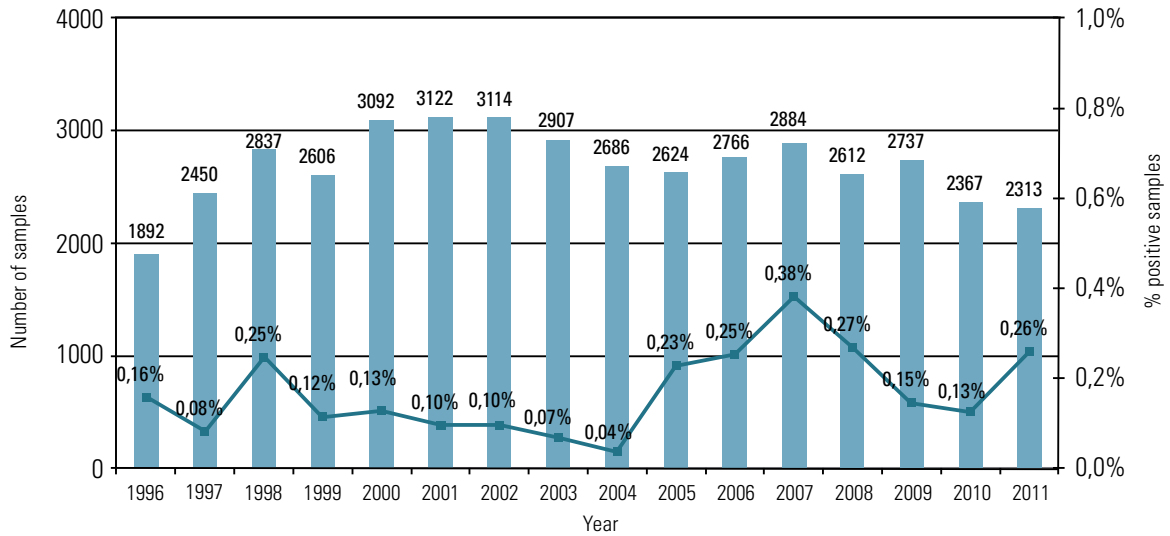
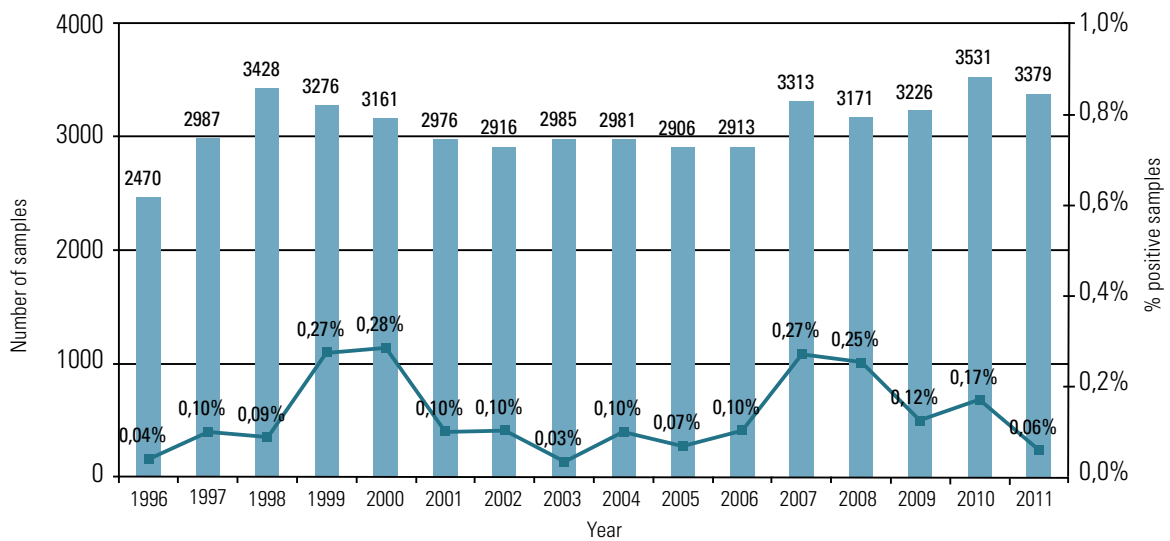


Figure 8. *Salmonella* in lymph nodes of fattening pigs



Humans

During 2011 a total of 2,885 cases of salmonellosis were reported (Figure 10), which is a 20 % decrease from the year before (3,609 cases). Domestic cases decreased slightly with 6% to 783 cases in 2011, an incidence of 8.3 cases per 100,000 inhabitants.

A majority of the cases are infected abroad (73% in 2011). However, travel-associated cases decreased with 24% to 2,072, despite an increase in international travels. The number of cases infected abroad has been decreasing since the beginning of 2000. In 2011, the travel-associated cases were fewest since the beginning of the 1980's. The observed decrease has been most clear for those travelling in Europe. As in previous years, the infection was most com-

monly acquired in Thailand (623 cases) followed by Turkey (n=293), Egypt (n=152), Spain (n=108) and India (n=61). The largest decrease (52%) was seen for those cases infected in Egypt, as a result of decreased travels to Egypt in 2011 due to political instability in the country.

Among the domestic cases, 49% were adults between 30-69 years. Children aged 0-9 years accounted for 16% of the domestic cases. The proportion of adults was higher among travel-associated cases compared to domestic ones. The gender distribution was even for the travel-associated cases but slightly more women than men were reported among the domestic cases.

Table 11. Reported cases of *Salmonella* in cats, dogs, horses, sheep, reptiles and wild birds in 2011.

Serotype	Phagetype	Cat	Dog	Horse	Sheep	Rep- tiles	Wild birds	Other wild animals
S. Brandenburg	not relevant		1					
S. Giza	not relevant					1		
S. Kisarawe	not relevant					1		
S. Muenchen	not relevant					1		
<i>Salmonella enterica</i> sp <i>arizonae</i>	not relevant					1		
<i>Salmonella enterica</i> sp <i>enterica</i> O 4,5:-:1,5	not relevant			1			1	
<i>Salmonella enterica</i> sp <i>enterica</i> O 4:i:-	not relevant						1	
<i>Salmonella enterica</i> sp <i>enterica</i> O 4,5:i:-	not relevant		1					
<i>Salmonella enterica</i> sp <i>enterica</i> O 4,5:b:1,2	not relevant					3		
<i>Salmonella enterica</i> sp <i>diarizonae</i>	not relevant				2	1		
<i>Salmonella enterica</i> sp <i>salamae</i>	not relevant					1		
S. Tennessee	not relevant					3		
S. Typhimurium	PT 40	1						
S. Typhimurium	PT 146			1				
S. Typhimurium	U277	1						
S. Typhimurium	RDNC	4		3			1	
S. Typhimurium	not phagetyped	8	1				3	1
not serotyped		14						
<b>Total</b>		<b>28</b>	<b>3</b>	<b>5</b>	<b>2</b>	<b>12</b>	<b>6</b>	<b>1</b>

As for previous years, most cases were reported from the three largest counties in Sweden (Stockholm, Västra Götaland and Skåne). However, the counties with larger outbreaks during 2011 had the highest incidences; Dalarna (15.2), Västerbotten (13.1), Örebro (11.7) and Värmland (11.0).

Among the domestic cases, 95% of the isolates were serotyped compared to 13% for the travel-associated cases. *S. Typhimurium* dominated among the typed domestic isolates (25 %) followed by *S. Enteritidis* (19%) and monophasic *Typhimurium* (*S. enterica* sp. *enterica* 1,4,[5],12:i:-) (10 %). Phage types NT (Non Typable), 1, 104, 120 and U302 were most

common domestic *S. Typhimurium* subtypes. *S. Enteritidis* accounted for 46% of the typed isolates from travel-associated cases. In Sweden *S. Typhimurium* is the most common domestic serotype whereas in most European countries it is *Enteritidis*.

*Salmonella* cases are reported with a clear seasonal variation with most cases during the warmer months May to September. In 2011 more than one third of all domestic cases were reported in July and August, mainly due to three larger outbreaks in those months. Most travel-associated cases are reported during January to March when travelling to warmer destinations is more common.

Figure 9. *Salmonella* in neck skin samples of poultry at major slaughterhouses.

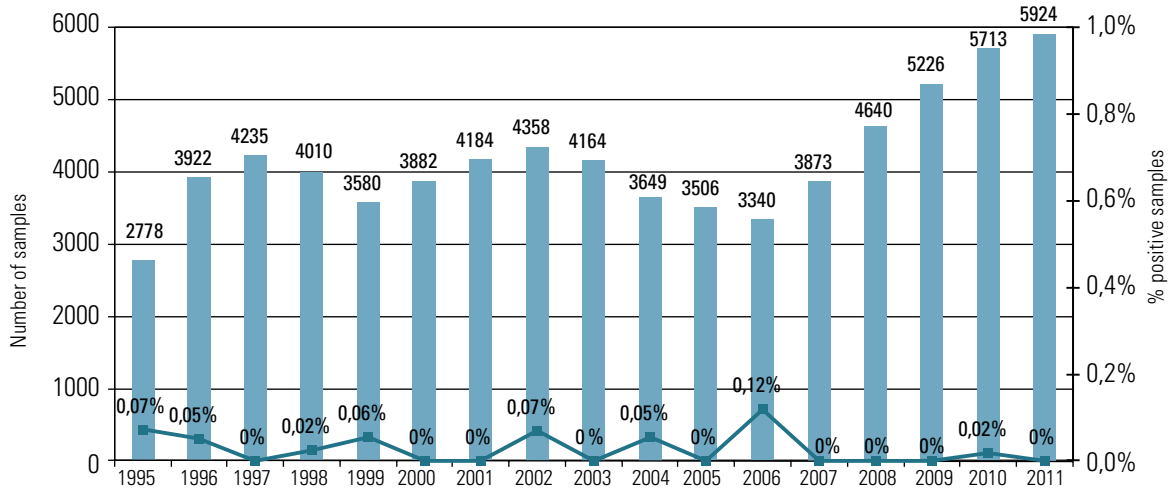
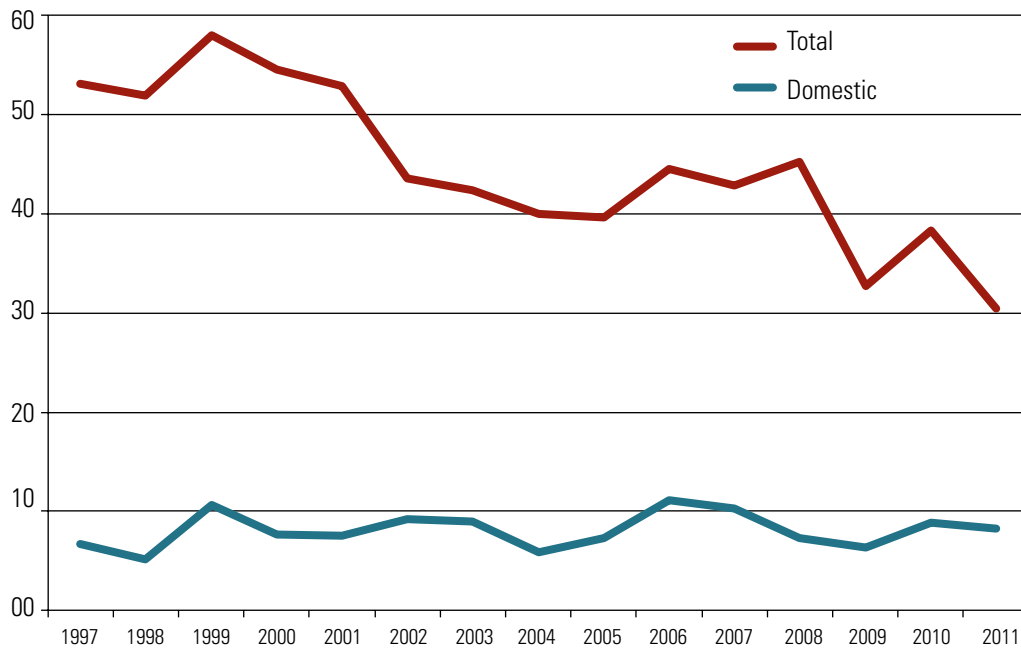


Figure 10. Notified incidence (per 100,000) of human salmonellosis in Sweden, 1997-2011.



During 2011, 14 domestic *Salmonella* outbreaks were reported with 235 notified cases. More outbreaks were observed the year before but with a similar number of cases. Some outbreaks were local caused by poor food hygiene at restaurants but some larger national outbreaks were noted. Outbreak investigations were challenging. Unfortunately the source could seldom be revealed. Many of the serotypes were previously rarely reported in domestic infections and more associated with international travel.

In summer, *S. Enteritidis* phage type 29 caused the largest outbreak involving 50 case patients spread over the country. Ready-to-eat chicken salad was suspected as a source but despite extensive sampling this could not be confirmed. The second largest outbreak during the summer was caused by *S. Abony* affecting nearly 50 persons across the country. Despite an extensive epidemiological investigation, the source could not be found. In a third outbreak also during the summer, around 30 persons were infected with *S. Haifa*, a serotype more

commonly isolated from travel-associated cases. Imported red onion was suspected as a source but despite sampling this could not be confirmed. A prolonged outbreak of *S. Poona* extending from autumn 2010 to spring 2011 was suggested to be associated with eating cashew nuts from India. *S. Poona* is also mostly associated with travel. At the end of 2011 a national outbreak of *S. Paratyphi B* variant Java comprising approximately 20 cases was identified. The outbreak strain was indistinguishable in PFGE analysis with a strain from a large outbreak in 2007. That outbreak involved both Sweden and several other countries in Europe. This particular strain has since then been reported in other outbreaks in Europe and also sporadically over the years in Sweden. In 2007, the source was imported baby spinach but this link could not be confirmed in the outbreak 2011.

#### DISCUSSION

The low proportion of domestic human infections is unique for Sweden, Norway and Finland compared to most European countries. In order to trace and further control the sources of infection it is therefore important not only to report the total incidence in humans but also domestic incidence. The total notified incidence in 2011, 30.4 cases per 100,000 inhabitants is considerably higher compared to the domestic figure of 8.3 cases per 100,000 inhabitants. The Swedish situation with few domestic human cases reflects the good *Salmonella* situation in domestic animals and food.

In the feed sector, data from 2011 showed similar findings as in the previous year with *S. Typhimurium* as the most frequently isolated serotype in the weekly surveillance of feed mills. This can to a large extent be attributed to one single major feed mill that still had problems with *Salmonella* contamination in the vicinity of the production line. On the other hand, no *S. Typhimurium* has been found in production line or in the environment after the heat treatment step of feed at the same establishment.

The number of cattle herds (n=6) detected with *Salmonella* in 2011 was similar to the previous year but less than in 2008 (n=21) and 2009 (n=19) (Figure 11). In 2008 bulk milk screening for *Salmo-*

*nella* was performed and this resulted in more findings of infected herds. In 2009 extensive samplings were performed during a *Salmonella* outbreak in the County of Skåne. Less sampling of cattle herds rather than decrease in the number of infected herds seems to be the reason for detection of fewer cattle herds in 2010 and 2011.

During 2010, *S. Derby* was repeatedly detected in swine herds with outdoor rearing management (Figure 12). The source of the infection in the present cases has not been revealed.

Reported domestic human cases of *Salmonella* vary from year to year depending on the number of outbreaks. According to a trend analysis the total number of notified human cases has significantly decreased between the years 1997-2009, but a trend could not be identified for the domestic cases. The largest decrease is seen for the travel-associated cases especially cases reported from European countries. The decrease of *Salmonella* cases has been seen in countries in the whole EU union for the last six years and is considered to be the result of the harmonised *Salmonella* control programs set in poultry. Interestingly, also for Thailand, the most common country of travel-associated *Salmonella*, a decrease in risk (cases per travels) has been observed. However, actual information to travellers about risks of contracting *Salmonella* and other infectious diseases is still needed to further decrease the incidence. Also, information on how to prevent secondary transmission to other persons, to the environment and to animals when returning back to Sweden is also crucial.

Investigations of the 2011 national outbreaks were difficult and did not reveal any confirmed sources. It was challenging to confirm suspected food sources as sampling delay and the actual batch were not any more in the market.

As the case patients were living across the country the outbreaks were most likely caused by food items widely spread in Sweden. The causative sero- and phage types have rarely been observed in domestic human cases or animals. This indicates that contaminated imported food items were most probably the vehicles. Also, statistics of domestic outbreaks over

time confirms the observations of 2011; very few outbreaks are caused by food items originating from Swedish raw materials.

An increased awareness regarding the risk of *Salmonella* in imported food, especially such as leafy green vegetables is needed as these products are commonly not cooked or heated prior to eating as compared to meat products.

Routine subtyping by MLVA of isolates of *S. Typhimurium* from humans and comparison with isolates from animals, food, feed and the environment has proved to be a useful tool to detect clusters and outbreaks. PFGE is another useful molecular tool to identify sources in outbreaks and to connect cases to outbreaks, both with historical cases and with present cases as seen with the outbreak of *S. Java*.

Monophasic *Salmonella* (*S. enterica* sp. *enterica* 1,4,5,12:i:-) has increased in recent years in Sweden and in other European countries which has led to ongoing investigations. In order to better understand this emerging type a joint national project between human and veterinary institutes started in 2010.

The Swedish *Salmonella* control program has been in place for decades. It is extensive and the continuous work has resulted in a very favourable *Salmonella* situation in domestic animals (Figures 11-14). However, the program is costly and could be modernised. Therefore, a new national plan to control and monitor *Salmonella* in a cost-effective way is in progress.

Figure 11. Notified incidence of *Salmonella* in Swedish cattle herds during 1968-2011.

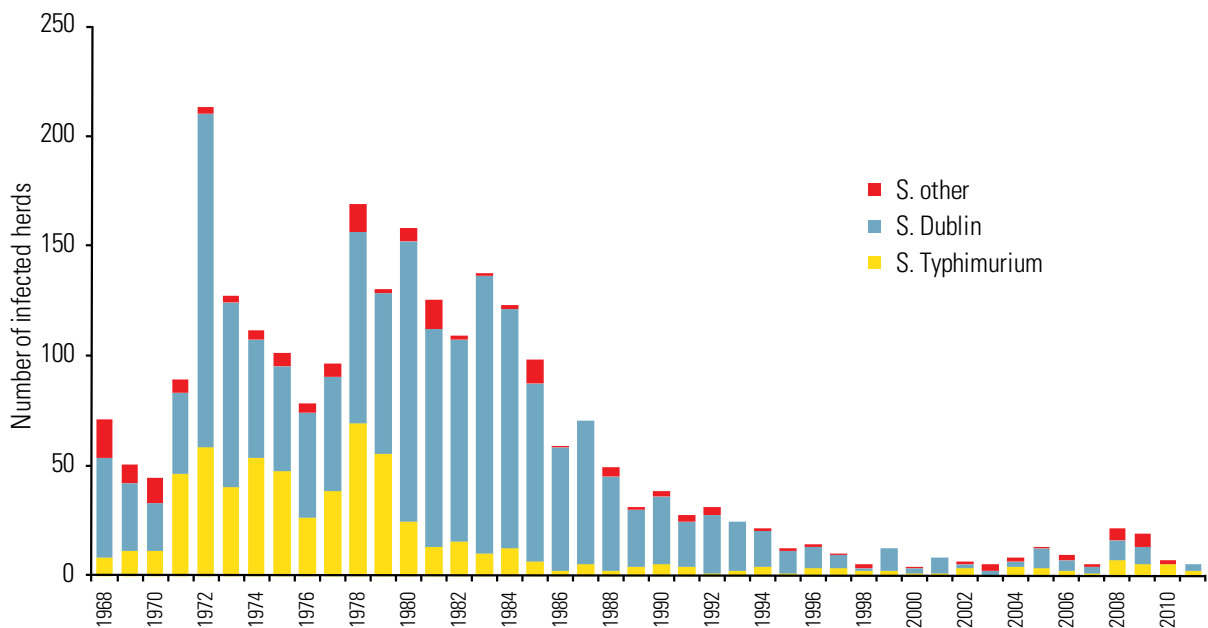


Figure 12. Notified incidence of *Salmonella* in Swedish pig herds during 1968-2011.

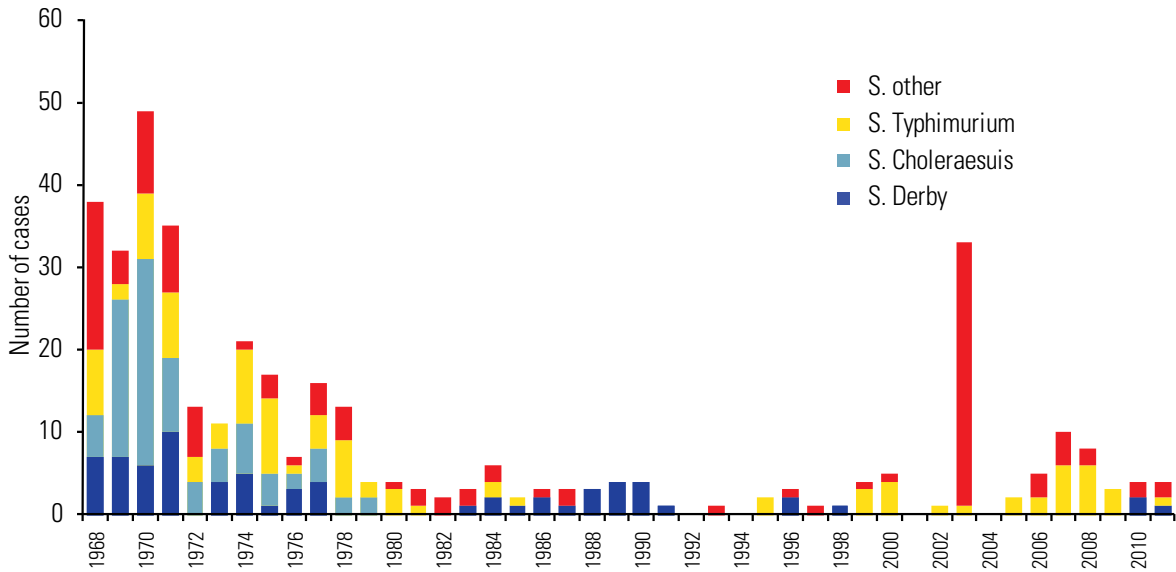


Figure 13. Notified incidence of *Salmonella* in Swedish layer holdings during 1968-2011.

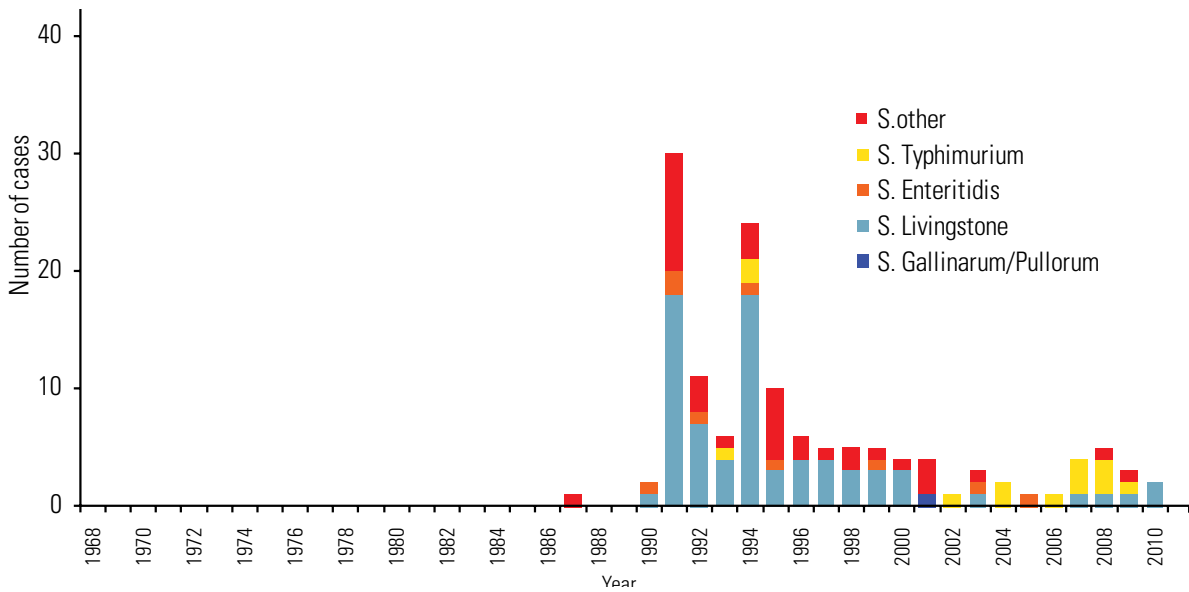
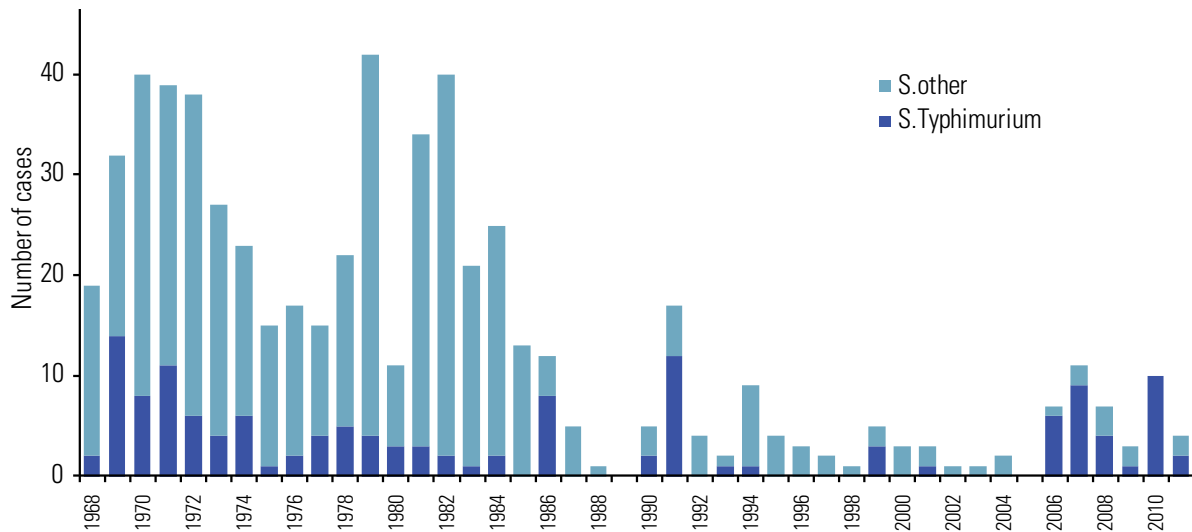




Figure 14. Notified incidence of *Salmonella* in Swedish broiler holdings during 1968-2011, breeding flocks included.

## REFERENCES

EFSA and ECDC zoonoses report: Salmonella in humans continues to decrease, Campylobacter increasing, EFSA press release 8 March 2012 <http://www.efsa.europa.eu/en/press/news/120308.htm>

Importlivsmedel sannolikt orsaken till flera salmonellautbrott i Sverige, SMI Newsletter, 15 September 2011, available online (in Swedish) <http://www.smittskyddsinstitutet.se/nyhet-sarkiv/2011/importlivsmedel-sannolikt-orsaken-till-flera-salmonellautbrott-i-sverige/>

Wierup M, Häggblom P., 2010. An assessment of soybeans and other vegetable proteins as source of Salmonella contamination in pig production. *Acta Vet Scand.* 2010 Feb 17;52:15.

Sternberg Lewerin, S., Wahlström, H, Häggblom, P., Szanto, E., Plym Forshell, L., 2006. The Swedish national salmonella control program –future challenges. In the proceedings of I3S, International Symposium on Salmonella and Salmonellosis, St Malo, France, May 2006. Pp 531-534.

Sternberg Lewerin, S., S. Boqvist, P. Häggblom and B. Engström, 2005. Chapter 8. The effective control of salmonella in Swedish poultry. In: Food safety control in the poultry industry. Ed.: G. Mead. Woodhead Publishing Ltd, Cambridge, UK. 195-215

# Scrapie

## BACKGROUND

Scrapie belongs to the group of diseases called Transmissible Spongiform Encephalopathies (TSE) and was first described more than 250 years ago. The current theory about causative agent is the prion-only hypothesis. This theory assumes that misfolded prions (small proteins) induce the same pathological structure in normal proteins of the host resulting in accumulation of prions and cellular damage without involvement of any microorganism. Susceptibility to scrapie is genetically related. All routes of transmission have not been established, however, it is clear that spread can occur related to lambing.

After classical BSE became a disease of public health concern (see further chapter on BSE), and existence of BSE in small ruminants was suspected, both surveillance and control of TSE in small ruminants was increased within the European Union in 2002.

Classical scrapie has been detected in Sweden once, in a single flock in 1986. The whole flock was culled and the origin of the disease was never established.

In 1998 an atypical variant of scrapie was detected in Norway. The first Swedish case was detected in 2003, and since then a number of cases have been detected. Although atypical scrapie is experimentally transmissible, epidemiological studies on European level indicate that atypical scrapie may be a spontaneously occurring disease.

## DISEASE

The incubation period is long, up to several years. Symptoms of classical scrapie are related to the neurological system and include altered behaviour and sensation, affected movement and posture, as well as pruritus and skin lesions. The disease is progressive and always fatal.

## LEGISLATION

Surveillance and control is regulated through the Regulation (EC) 999/2001 of the European Parliament and of the Council of 22 May 2001. On national level surveillance and control is also regulated by the national scrapie control program and Sweden has since 2003 additional guarantees related to trade within the union (Commission Regulation

(EC) 546/2006). Moreover, sampling on national level is regulated by SJVFS 2010:9, saknr K19, amended through SJVFS 2011:29. Furthermore, scrapie is a notifiable disease under the Swedish Act of Epizootic diseases (SFS 1999:657, with amendments) and there is a scheme to compensate farmers for losses due to eradication measures.

## SURVEILLANCE

The Swedish Board of Agriculture is responsible for the surveillance program, which is carried out in cooperation with the National Veterinary Institute (SVA). SVA is appointed National Reference Laboratory, NRL (Regulation (EC) 999/2001. Samples are analyzed at the SVA.

### Passive surveillance

All suspicions of scrapie must be reported to the authorities. The obligation to report applies for animal owners, veterinarians and everyone else who is responsible for the animals. Samples from animals with clinical suspicion of scrapie are examined with Bio-Rad TeSeE short assay protocol (SAP) in combination with Bio-Rad TeSeE Western Blot.

### Active surveillance

The design of the surveillance program is in accordance with Regulation (EC) 999/2001 Annex III and the Swedish national control program. Within the program, all dead sheep and goats over 18 months of age which are not slaughtered for human consumption should be sampled. The carcasses are sampled at rendering plants and at autopsy. In remote areas where there is no collection of carcasses, the farmers shall send the whole skull to the SVA. Farms with confirmed cases of atypical scrapie are obliged to have increased surveillance in the herd during two years. In addition to fallen stock, healthy slaughtered animals above 18 months of age should be examined from these flocks.

The samples from active surveillance were examined Bio-Rad TeSeE short assay protocol (SAP) at SVA in accordance with Regulation (EC) 999/2001. In case of positive or inconclusive results the material was examined by Bio-Rad TeSeE Western Blot.

## RESULTS

### Passive surveillance

In 2011 two sheep were examined due to clinical suspicion of scrapie. They were negative for both classical and atypical scrapie.

## ACTIVE SURVEILLANCE

### Sheep

In 2011 SVA examined 6,965 sheep from fallen stock for scrapie. Out of these, all samples were negative for classical scrapie and three were positive for atypical scrapie Nor98.

### Goats

In 2011 SVA examined 19 goats from fallen stock for scrapie. All were negative both for classical scrapie and for atypical scrapie.

## DISCUSSION

### Classical scrapie

Since the start of the active surveillance in 2002, more than 55,000 sheep have been tested without any positive cases detected. There is no central register for individual sheep and thus the number of dead animals cannot be compared to the number of sampled animals. Although not all sheep are collected, and although some of them are too autolysed to be sampled during the warmest summer months, the animals tested in 2011 still constitute approximately 2.6% of the population of adult sheep. The results support the freedom, or very low prevalence of classical scrapie in the country.

Sweden has additional guarantees related to scrapie when farmers import sheep or goats. However, illegal imports which are not detected could pose a potential threat to the current scrapie status in the Swedish sheep and goat population.

### Atypical scrapie

Since the first case of atypical scrapie was detected in Sweden in 2003, in total 25 cases have been detected until the end of 2011. Out of these, two were detected through passive surveillance and the rest through active surveillance. Currently the flocks are put under intensified monitoring in accordance with the regulation (EC) 999/2001. No additional cases of atypical scrapie have been found in the positive flocks. On European level, two epidemiological studies have concluded that the prevalence is similar in different countries and that the prevalence in positive flocks does not differ from the prevalence in the rest of the sampled population. This pattern differs from the way contagious disease are normally distributed in the population and support the hypothesis that atypical scrapie is spontaneously occurring. However, transmission studies have shown that atypical scrapie can be transmitted to sheep and other species under experimental conditions. Although potential within flock transmission directly between animals seem to be very low (if it all exists) other routes of spread and the potential zoonotic aspect are being discussed.

## REFERENCES

- Fediaevsky A, Maurella C, Nöremark M, Ingravalle F, Thorgeirsdottir S, Orge L, Poizat R, Hautaniemi M, Liam B, Calavas D, Ru G, Hopp P. BMC Vet Res. 2010 Feb 7;6:9. The prevalence of atypical scrapie in sheep from positive flocks is not higher than in the general sheep population in 11 European countries.
- Fediaevsky A, Tongue SC, Nöremark M, Calavas D, Ru G, Hopp P. BMC Vet Res. 2008 Jun 10;4:19. A descriptive study of the prevalence of atypical and classical scrapie in sheep in 20 European countries.

# Swine Vesicular Disease

## BACKGROUND

SVD is a disease solely affecting pigs and it is caused by a porcine enterovirus closely related to human coxsackie B5 virus. The first report of SVD affected pigs was from Italy 1966 and the disease has since then been reported from several European countries and also from Japan and China. Today SVD is still present in Italy. The route of transmission is mainly by direct contact between infected and non-infected animals and by intake of feed contaminated with SVD virus.

## DISEASE

### SVD

Infection with SVD virus can lead to fever and blisters on the snout, tongue, teats and coronary bands and the similarity of these symptoms with the clinical signs seen in foot- and mouth disease (FMD) is the reason why this disease is surveilled and controlled in countries free of FMD. On most occasions the infection is very mild or subclinical.

## LEGISLATION

SVD is included in the Swedish Act of Epizootic diseases (SFS 1999:657 with amendments) and the control of the disease is regulated in detail through EU-directives.

## SURVEILLANCE

The purpose of the surveillance activities is to document freedom from SVD in the Swedish pig population and to contribute to the maintenance of this situation. The National Veterinary Institute (SVA) has been responsible for sample selection, sample analysis and reporting to the Swedish Board of Agriculture.

The serological analyses of SVD were performed at the National Veterinary Institute (SVA) using ELISA technique and positive results were confirmed with a serum neutralization (SN-) test.

## Passive surveillance

As SVD is notifiable on clinical suspicion for both veterinarians and farmers, cases with suspect clinical signs will be investigated following notification to the Swedish Board of Agriculture. The following investigation is included: restrictions on the farm during investigation, sampling of sick or dead animals and examination of the herd for prevalence of clinical signs and production results.

## Active surveillance

In 2011, sera for the active surveillance were collected by systematic random sampling from the surveillance carried out by the Swedish Animal Health Service for porcine respiratory and reproductive syndrome (PRRS).

## RESULTS

### Passive surveillance

No clinical suspicions of SVD were investigated during 2011.

### Active surveillance

Altogether 2,195 samples were analyzed and antibodies to SVDV were not found in any of these samples.

## DISCUSSION

The results from the surveillance in Sweden regarding SVD during 2011 give additional documentation of freedom from this infection in the Swedish commercial pig population.

# Tick-borne encephalitis TBE

## BACKGROUND

Tick-borne encephalitis virus (TBEV) belongs to the genus flavivirus in the family *Flaviviridae*. TBE virus is endemic in an area ranging from northern China and Japan, through far-eastern Russia to Europe. The virus may cause a neurological infection which may lead to long-term sequelae in the affected patients. The virus is spread by ticks (*Ixodes ricinus* and *I. persulcatus*), which are infected when they suck blood from infected rodents and roe deer, which are as well suggested as a possible virus reservoir. The virus is also circulating in the tick population through transovarial transmission without involvement of vertebrate hosts. Large species of mammals, predominantly ungulates, are important to maintain big tick populations. Humans mainly become infected via ticks, although unpasteurized milk, both goat's and milk from cows, and milk products have also been reported as sources. Vaccination of persons living, visiting or working in endemic areas is recommended.

Three virus sub-types of TBEV are described: the Western, Siberian and Far eastern subtypes. In Sweden, only the first one has been found.

The first case of TBE infection in Sweden was reported in 1954 and during the following three decades, there were 10-40 annual cases reported annually. From the mid-1980's a clearly increasing trend has been observed. The last years about 200 cases have been reported annually. With a few exceptions all the cases are endemic. Most have been infected at the eastern coast and archipelago close to the capital. The age distribution is wide but most of the cases are between 30 and 70 years. There is a slight overrepresentation of men. About 80% of the patients are diagnosed in July to October.

## DISEASE

### Animals

A few confirmed cases on naturally occurring disease in dogs are reported. Seroconversions are shown for grazing goats and cows. Most authors consider these animals as a dead end for the viral infection. Wild rodents though being the natural reservoir for TBEV are not reported to get the disease. Roe deers do seroconvert but there are no reports on the disease.

### Humans

In humans, a biphasic course of the disease is common. The first, viremic phase lasts for about four days. After an interval of about a week, a meningoencephalitic phase appears in about one third of the patients. The symptoms may include fever, headache, nausea, cognitive dysfunctions or spinal paresis, etc. The mortality is low, about 0.5%. The incubation period of TBE is usually between 7 and 14 days.

## LEGISLATION

### Animals

Demonstration of TBE virus in animals is not notifiable.

### Humans

TBE in humans is notifiable as a viral meningoencephalitis since 2004 according to the Communicable Disease Act (SFS 2004:168).

## SURVEILLANCE

### Animals

There is no surveillance in animals.

### Humans

The surveillance is passive in humans.

## RESULTS

### Humans

In 2011, 284 TBE cases were reported, which is the highest number since the infection was described for the first time in Sweden. As expected, more men (56 %) than women were reported with TBE. The median age was 47 years (2 to 87 years) and two thirds of the cases were in the age group 30 to 69 years.

A majority of the TBE cases (98%) had acquired their infection in Sweden. Other sites of infection were Åland (4 cases), Estonia (2 cases) and France (1 case).

The first TBE case fell ill in April and the last one in December, but the majority were in June to October.

The spread of the disease was mainly as the years before with a concentration of cases in the coastal areas of Stockholm, Södermanland and Uppsala counties, both along the lake of Mälaren and the Baltic Sea, Map 8. There were also cases infected along the coast of the Baltic Sea in the counties of Östergötland and Kalmar, close to the two big lakes Vänern and Vättern, as well as along the Swedish west coast from Gothenburg in the south and with a northward spread. As in previous years, occasional cases were infected along the coastline in Blekinge county and in the northeast and southeast corner of Skåne county. The northernmost reported cases were infected south of and close to the border of Gävleborgs county and there were also two cases in the southern part of Dalarna county.

Map 8. Place of infection of reported TBE cases in 2011.



## DISCUSSION

The large increase in the number of TBE cases seen in Sweden in 2011 was probably due to several interacting factors. The perhaps most important cause was presumably the very dense population of ticks, a consequence of a large roe deer population from the 1980s up until the recent snowy winters, 2009-2010 and 2010-2011. This situation in combination with many small host animals, for example bank voles, and optimal weather for both virus spread and humans spending time outdoors in 2011, could explain the large number of cases reported during the year.

# Trichinellosis



## BACKGROUND

Trichinellosis is caused by parasitic nematodes of the genus of *Trichinella*. Several species are included in the genus. In Europe, *T. spiralis*, *T. britovi* and *T. nativa* are the dominant causes of human infections. The parasites can be hosted by different mammals, such as domestic pigs and horses but the main reservoirs are wild carnivores and omnivores. Humans mainly acquire the infection by eating raw or inadequately heated contaminated meat and meat products, typically cold-smoked, fermented sausages. In Sweden, the species detected include the aforementioned three as well as *T. pseudospiralis* in later years. *T. pseudospiralis* has mainly been associated with carrion-eating birds, but has been found in wild boars. In the gut *Trichinella* larvae, develop into adults and mate. After mating, the female releases larvae which penetrate the intestinal mucosa and travel via the bloodstream to various organs and muscles. In striated muscles the larvae may survive for years.

In Sweden, *Trichinella* has been inspected at slaughter in domestic pig since the 20th century. During 1970-1990 sporadic cases were detected in domestic pig, but since 1994 there have been no cases. The parasite is endemic in Swedish wildlife.

The disease is extremely rare in Sweden and detected human cases are infected abroad. The most recent reported case (in 2007) had consumed wild boar sausage brought in privately from Spain. The preceding case occurred in 2003 after consumption of cold-smoked ham in the Balkans. Before that there had not been a case since 1997, which also was travel-associated.

## DISEASE

### Animals

Animals rarely develop a clinical infection, although both pigs and rodents can exhibit the typical symptoms during experimental infections.

### Humans

The disease can range from subclinical infection to fatal disease. The incubation period varies from 5-15 days. Symptoms initially involve diarrhoea and abdominal pain and later muscle pain, fever, oedema of the upper eyelids and photosensitivity. Early stages of the disease respond well to treatment. Cardiac and neurological complications may occur 3-6 weeks post infection. Trichinellosis is not transmitted between humans.

## LEGISLATION

### Animals

*Trichinella* is notifiable in animals according to SJVFS 2002:16 with amendments.

### Humans

Trichinellosis is notifiable according to the Communicable Disease Act (SFS 2004:168).

## SURVEILLANCE

### Animals

All slaughtered domestic pigs and wild boar as well as horses and hunted wild boars and bears are tested for *Trichinella* by the digestion method. In addition, several species of wild animals are tested for *Trichinella*, including e.g. fox, lynx, wolves, badgers, birds and wolverines. *Trichinella*-free regions have not been created in Sweden.

### Humans

The surveillance is passive.

## RESULTS

### Animals

In 2011, all slaughtered domestic swine (2,845,390) and horses (4,330) were tested for *Trichinella*. *Trichinella* was not detected in domestic pigs or horses. *Trichinella* spp. was detected from two of 38,921 (0.005%) wild boar samples. *Trichinella* was also detected from 11 lynxes, 5 red foxes, 2 wolverines and 1 wolf, (Table 12).

### Humans

No human cases of *Trichinella* were reported in 2011.

## DISCUSSION

Trichinellosis is extremely rare in Swedish food-producing animals and detected human cases in the last decades were infected abroad. The *Trichinella* situation in Swedish animal population seems to be stable. *Trichinella* occurs in wild carnivores but the risk of getting *Trichinella* from domestic pigs and horses is negligible. Establishing *Trichinella*-free regions may be considered.

Table 12. Findings of *Trichinella* in wild animals 2011.

Animal species	No. Samples	No. Positives	Percentage (%)	<i>T. britovi</i>	<i>T. nativa</i>	<i>T. spiralis</i>	<i>T. pseudo-spiralis</i>	<i>T. spp.</i>
Badgers	4	0	0,00%					
Bears	242	0	0,00%					
European Pine Marten	2	0	0,00%					
Lynxes	132	11	8,33%	3	8			
Otters	12	0	0,00%					
Raccoon dogs	48	0	0,00%					
Red foxes	326	5	1,53%	2	3			
Wild birds	37	0	0,00%					
Wild boars	38921	2	0,01%				2	
Wolverines	9	2	22,22%		2			
Wolves	40	1	2,50%					1



# Tuberculosis



## BACKGROUND

Tuberculosis (TB) is a serious disease in humans and animals caused by bacteria included in the *Mycobacterium tuberculosis* complex. *Mycobacterium bovis* causes bovine tuberculosis in several animal species as well as in humans. Historically, the reservoir has been cattle but many other wild and domestic species can also maintain the infection. Wildlife reservoirs in e.g. badgers, deer and wild boar cause persistent problems in some countries. Humans usually acquire *M. bovis* infection via unpasteurized milk or via inhalation. The predominant cause of human tuberculosis is however *Mycobacterium tuberculosis*. In countries where human tuberculosis caused by *M. tuberculosis* is common, this bacterium is also frequently isolated from various species of animals.

Sweden was declared officially free from bovine tuberculosis in 1958. Since then, sporadic cases have occurred in cattle, the most recent in 1978. Compulsory tuberculin testing of all cattle was abolished in 1970 and the national tuberculosis control in cattle is based on meat inspection and passive clinical surveillance.

When Sweden joined the European Union in 1995, the status of OTF (officially tuberculosis free) was obtained (former Decision 95/63/EC, Commission Decision 03/046/EG).

In 1987, *M. bovis* infection was introduced into the farmed deer population. A control program for tuberculosis in farmed deer was introduced in 1994 and made compulsory in 2003. The last case of tuberculosis in farmed deer was identified in 1997.

The yearly incidence among humans in Sweden in the early 1940's was above 300/100,000 inhabitants. This was followed by a rapid decline, beginning before effective treatment was available in the early 1950's. Currently, the yearly incidence is about 6/100,000 inhabitants, which is among the lowest in the world. The vast majority of the cases occur in immigrants originating from countries that still have a high incidence of tuberculosis.

### DISEASE

The symptoms caused by tuberculosis in both humans and animals depend largely on the localisation of the infection. The disease progresses slowly and symptoms may take a long time to develop, even in cases with substantial lesions. Weight loss and sometimes coughing (in cases with respiratory tract infection), ascites (due to infection in intestinal lymph nodes or liver) or mastitis (mainly in cattle with udder infection) can be seen. The incubation period varies from weeks to years.

### LEGISLATION

#### Animals

Suspect cases of infection with *Mycobacterium bovis*, *M. tuberculosis*, or other mycobacteria in the *M. tuberculosis*-complex, are notifiable in all animal species according to the Swedish Act of Epizootic diseases (SFS 1999:657, with amendments).

#### Humans

Tuberculosis in humans is a notifiable disease according to the Communicable Disease Act (SFS 2004:168). Contact tracing is compulsory and the treatment is free of charge. Refusing treatment if the patient is contagious can lead to detention.

### SURVEILLANCE

#### Animals

From suspect cases in animals, lymph nodes from five different areas (retropharyngeal, submandibular, mediastinal, mesenterial and inguinal) and organs with macroscopic lesions are collected. Histology and direct smears are performed on all materials. If TB cannot be ruled out by histology or if direct smears are positive, culture is performed. Cultures are performed on solid media (Löwenstein-Jensen and Stonebrink's) according to the method at the National Veterinary Institute (SVA) for up to eight weeks. Microscopy of all suspect colonies is performed and bacteria in the *M. tuberculosis*-complex are identified with a specific genetic probe. Positive isolates are further subtyped.

Skin fold tuberculin tests are performed according to EC 1226/2002 (amending annex B of EC 64/432) and SJVFS 2003:33, K62. The comparative intradermal test is used, mostly at the neck site except for camelids where the auxilliary site is used. In case of a positive tuberculin test, the animal is culled and sampled as stated above. Culture is performed on all samples.

#### Humans

In humans sputum smear is the standard test when pulmonary tuberculosis is suspected. Otherwise culture from urine, feces, blood or liquor is also a possibility or biopsies from suspected site of infection.

### PASSIVE SURVEILLANCE

#### Animals

As TB is notifiable on clinical suspicion, clinical symptoms in animals or lesions detected at necropsy of an animal, prompt official investigations including sampling for bacteriology, tuberculin testing of contact animals and epidemiological investigation, are carried out.

In addition, an investigation is performed if there is reason to suspect exposure of animals to bacteria of the *M. tuberculosis*-complex.

Furthermore, tuberculin tests are performed at artificial insemination centres and at export/import of animals as required according to EU-legislation (Council Directive 64/432/EEC).

#### Humans

The surveillance in humans is passive. Asylum seekers from high incidence countries are offered health examination where screening for TB is included.

### ACTIVE SURVEILLANCE

#### Animals

Monitoring is performed by meat inspections at slaughter of food producing animals. Veterinary officers of the National Food Agency perform the inspections. Suspect lesions are sent to the SVA for histology and bacteriology.

The control program in farmed deer is based on regular whole-herd tuberculin testing, or whole-herd slaughter and meat inspection. Deer may only be sold for direct slaughter unless they originate from a herd that has undergone three consecutive herd tests and continue to test regularly.

### RESULTS

#### Animals

The number of animals investigated by histology and, if relevant, bacteriology, due to lesions detected at slaughter were 44 pigs, 14 deer, 4 sheep, one cow and one moose. From these samples, bacteria from the *Mycobacterium avium/intracellulare*-complex were isolated in 27 pigs. No other samples yielded any mycobacteria.

Due to clinical suspicions or lesions found at necropsy, samples from one alpaca, one wildebeest, one capybara, and a dog were investigated. TB could be ruled out by histological examination. One sputum sample from a tapir was examined by culture and no growth of *Mycobacteria* was found.

Close to 630 holdings were registered for farmed deer, however a large proportion of these do not have deer. The number of herds considered active, kept deer and had obtained TB free status, was approximately 400. Sixteen herds were not tested and four of these herds will be depopulated in 2012 or 2013. The remaining 12 herds are exempted from regular testing and instead slaughtering 20% of the herd yearly with meat inspections and necropsies for 15 years to obtain a free status. No TB was detected in any farmed deer in Sweden during 2011.

#### Humans

Two cases of *M. bovis* were reported in humans in 2011. One case originated from a TB endemic country and was most likely infected before arrival in Sweden. The other case was a 76-year old Swede and most likely infected when young.

## DISCUSSION

### Animals

The officially free status as regards bovine tuberculosis has been maintained during 2011. The overall TB situation in animals and humans remains favourable. No cases of TB were detected in Swedish animals during 2011. Although the surveillance is mainly dependent on inspections of slaughtered animals, this is regarded as sufficient for monitoring. However, the submission rates of lesions from slaughtered ruminants should be improved. Passive surveillance based on clinical suspicions and necropsy findings will always be of low sensitivity as clinical symptoms and massive lesions are mainly seen in late stages of the infection.

The eradication efforts in farmed deer have been successful and the probability that Swedish farmed deer are TB free is high. The aim is to be able to declare the remaining deer herds officially free.

The broad host range, long incubation period and low sensitivity of tests for tuberculosis means that introduction of live animals from endemic regions poses a constant risk.

### Humans

The rapid decline of tuberculosis in humans in the 1940's coincided with the eradication of tuberculosis in cattle and started before the introduction of effective treatment in the 1950's. A much larger part of the population lived in close contact with domestic animals then and it is likely to be more than a coincidence. Today Sweden has one of the lowest incidences of human tuberculosis in the world.

### REFERENCES

Wahlström, H., Frössling, J., Sternberg Lewerin, S., Ljung, A., Cedersmyg, M. and Cameron, A., 2010. Demonstrating freedom from infection with *Mycobacterium bovis* in Swedish farmed deer using non-survey data sources. *Preventive Veterinary Medicine* 94:108-118.

# Tularaemia

## BACKGROUND

Bacterium *Francisella tularensis* is the causative agent of tularaemia, a disease affecting humans and several animal species. *F. tularensis* comprises several subspecies which show differences in virulence. *F. tularensis* subsp. *holarctica* (type B) is the main subspecies responsible for human and animal infection in Europe.

*F. tularensis* is capable of surviving for weeks at low temperatures in water, moist soil, or decaying plant and animal matter. Although many different animal species can be infected, tularaemia is typically found in hares and rodents.

Humans become infected through a variety of mechanisms such as handling infected or dead animals, bites of infected insects or other arthropods, ingesting contaminated food or water, and inhaling aerosols of bacteria. Clinical disease is variable and dependent on the route of transmission. The infection is more often reported in men than in women, which might be attributed to their leisure and professional activities. The age group of 30-65 years is the most affected in both genders. Tularaemia might spread during the whole year, but it is most frequent during late summers.

Sweden has reported cases of endemic tularaemia since 1931. Ever since the first Swedish tularaemia case was reported an endemic area has been identified in northern and central Sweden.

The mountain hare is the animal species in which tularaemia has most frequently been identified in endemic areas in the past. However, in recent years, tularaemia has been detected in the European brown hare in new geographic areas.

The yearly numbers of notified human cases range from a few cases to more than 2,700 cases in 1967.

## DISEASE

*F. tularensis* is highly infectious, as few as 10–50 colony forming units may cause infection. The incubation period is usually 3–5 days. Tularaemia can be manifested in different forms depending on the route of transmission and on the virulence of the organism. These forms are: ulceroglandular, oculoglandular, pneumonic, oropharyngeal, gastrointestinal and typhoidal.

## Animals

In Swedish hares and in many rodent species that die of tularaemia, the pathological presentation of the disease is a disseminated multi-organ septicemic form.

## Humans

The ulceroglandular form is the most common form; the respiratory, oculoglandular and oropharyngeal forms being less common. In the ulceroglandular form, a local ulcer usually appears at the site of infection and the adjacent lymph nodes are enlarged. The general symptoms of tularaemia are high fever, headache and nausea.

## LEGISLATION

### Animals

Tularaemia is notifiable in animals (SJVFS 2002:16 with amendments).

### Humans

Tularaemia has been a notifiable disease since 1970 according to the Communicable Disease Act (SFS 2004:168).

## SURVEILLANCE

### Animals

No active surveillance is performed in animals. Surveillance is based on voluntary submission of animals found dead or euthanized by hunters and the general public. The detection is based on direct immunofluorescence and immunohistochemistry of the sample.

### Humans

The surveillance is passive. For laboratory verification of the infection both serology, PCR and isolation of the bacteria could be used.

## RESULTS

### Animals

*F. tularensis* was detected from eleven wild animals: six brown hares and five mountain hares. Five of the hares were from Uppsala region and one from a county south of the capital Stockholm. All the other animals were from the former endemic area.

## Humans

In 2011, 350 cases of tularaemia were reported, which is a 28 % decrease from 2010 (Figure 15). Despite this decline, 350 cases are a relatively high number and the decrease is in line with the natural fluctuations in the number of tularaemia usually observed. The exact cause of this decrease is unclear, but it is probably due to several factors combined like the number of reservoirs and mosquitoes as well as the weather conditions.

More men (63 %) than women were reported infected. That is the common sex distribution and seen over a longer time period 40 % more men than women have been reported. For both sexes, the incidence of tularaemia was highest in the age group 40-69 years.

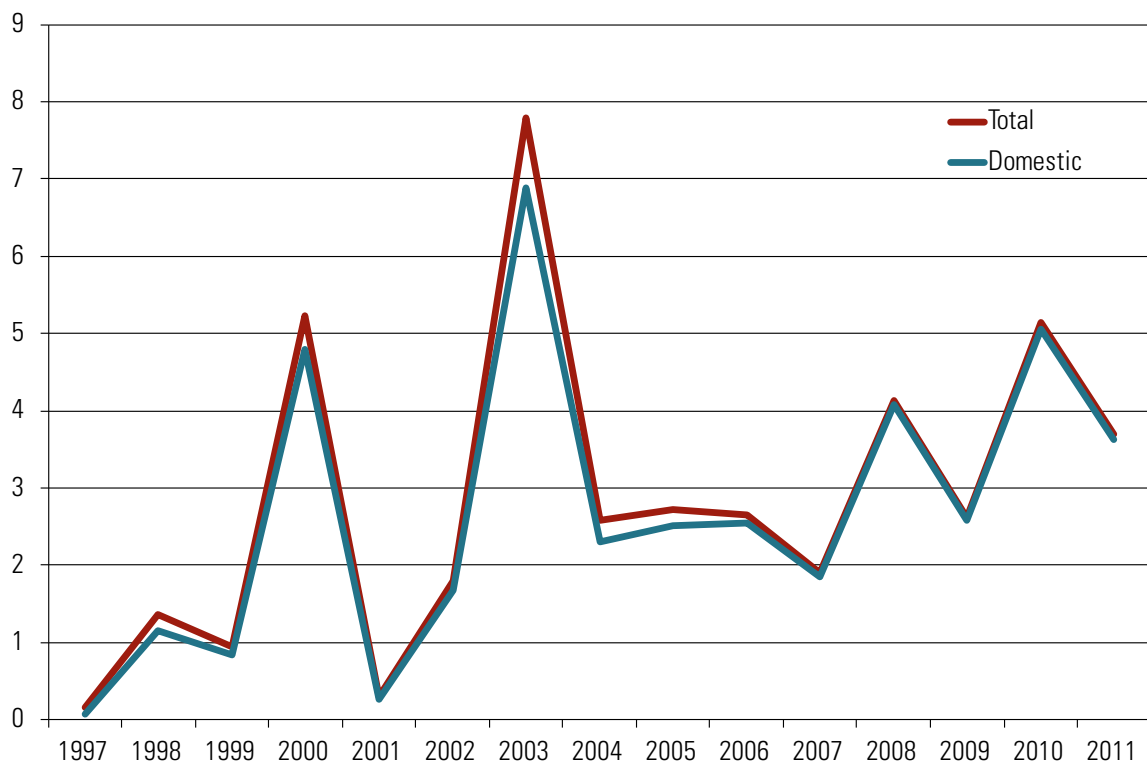
Almost all (98 %) cases were reported as domestic. As in previous years, except from a few sporadic cases, tularaemia was only reported from northern, western and central parts of Sweden. The incidence was by far highest in a northwestern county, the county of Jämtland (37 cases per 100 000 inhabitants) and more than twice as high as in Västerbotten, the county with the second highest incidence. The national decrease in number of reported cases was also reflected in most single counties. On the

contrary, the incidence increased in the counties of Västra Götaland, Gävleborg, Västerbotten and Norrbotten. The increase was most pronounced in the northernmost counties in Sweden, probably to some extent due to the large lemming populations there during the year. One person was infected in southern Sweden, in the county of Skåne. Last time that happened before was in 2004, when three persons fell ill.

In most of the tularaemia reports, no route of transmission had been stated, but probably a majority of the cases had been infected via an insect bite. There are estimations that about 90 % of the Swedish tularaemia cases are caused by mosquito bites. In 2011, 35 cases were assumed to have been infected through direct contact with animals. In one of these occasions, both the hunter and the hunted brown hare tested positive for tularaemia. Four persons were probably infected by drinking contaminated water.

The vast majority of the cases were reported in August to October, which is the usual seasonal distribution with a peak of cases in September or October.

Figure 15. Notified incidence (per 100,000) of human tularaemia in Sweden during 1997-2011.





#### DISCUSSION

Tularaemia has been endemic in northern and central Sweden at least since the early 20th century with a marked variation in the number of cases between different years. Years with high numbers of cases are often followed by periods when the disease is virtually absent. There is no obvious explanation for these fluctuations. The reservoir for the bacterium between outbreaks has not been clearly elucidated. During the last decade, the epidemiology of tularaemia has changed and the number of reported cases in humans and animals infected south of the previous endemic region has increased. In animals, outbreaks of tularaemia have been associated with rises in rodent and hare populations, but this has not been confirmed in Sweden. It is possible that the European brown hare has become an important carrier of *F. tularensis* in many areas, but its epidemiological role remains unclear.

# Verotoxinogenic *Escherichia coli*

## BACKGROUND

Verotoxinogenic *Escherichia coli* (VTEC) may cause serious intestinal infections in humans. When these bacteria cause hemorrhagic diarrhoea they are called EHEC (enterohaemorrhagic *E. coli*). More than 380 different VTEC serotypes have been associated with human illness but most outbreaks and severe disease are caused by serotype O157:H7. Other common serotypes causing gastrointestinal illness are O26, O103, O111 and O145. Cattle are the main reservoir of VTEC associated with human disease although other animal species also may acquire the organisms. The infectious dose is low, probably less than 100 bacterial cells. Not only foods of bovine origin but also vegetable food items and drinking water have been implicated in outbreaks. The infection can also be transmitted through direct or indirect animal contact, via environment or person-to-person transmission.

VTEC was only sporadically detected in Sweden until 1995 when 114 human cases of VTEC O157:H7 were notified. In 1996, VTEC O157 was isolated in Swedish cattle for the first time and human *E. coli* O157 infection was traced to a cattle herd. In 2002 an outbreak of VTEC O157:H7 in the county of Skåne affecting 30 persons was caused by consumption of cold smoked fermented sausage. The biggest Swedish outbreak so far occurred in the summer of 2005 when 135 notified cases, including 11 (8%) HUS (haemolytic uraemic syndrome) cases were infected with O157:H7 after eating contaminated fresh lettuce irrigated with water from a local stream positive for verocytotoxin 2 at the time of harvest. Indistinguishable isolates from humans and cattle faeces from a farm upstream confirmed the implicated source and control measures that lead to the termination of the outbreak were implemented. In 2011, one of the largest known VTEC outbreaks occurred in Germany with 3,842 reported cases and many cases also in other countries. Sweden reported the highest number of cases outside Germany (n=53). The epidemiological characteristics of the cases and the massive media impact and public awareness make this outbreak unique.

Around 250-350 cases of EHEC are reported annually, of which 50 -65% are domestically acquired. Most of the cases are reported during the period July to September.

National guidelines were established in 1997 and were revised in 2008. The aim is to minimize the spread of VTEC to humans and animals. A risk profile was produced by the responsible authorities in 2007.

## DISEASE

### Animals

Animals usually do not develop a clinical disease.

### Humans

The clinical picture may vary from asymptomatic infection to non-haemorrhagic or haemorrhagic diarrhoea associated with abdominal cramps. Most patients recover fully. Approximately 7-10% develop HUS, which is characterised by acute renal failure, thrombocytopenia, and microangiopathic haemolytic anaemia. A large proportion of the patients are young children and severe complications are most common in this age group and among elderly people. HUS may lead to renal failure or death.

## LEGISLATION

### Animals

Since 1999 VTEC O157 findings in animals are only notifiable when associated with human VTEC infection (SJVFS 2002:16 with amendments).

### Humans

EHEC O157 has been notifiable for both clinicians and laboratories under the Swedish Communicable Disease Act since 1996. All EHEC serotypes pathogenic to humans are notifiable since 1 July 2004 (SFS 2004:168).

## SURVEILLANCE

### Active surveillance

#### Animals

If a County Medical Officer suspects an association with a human VTEC infection to animals or to a farm with animals, the County Veterinary Officer will be informed. A request to the Swedish Board of Agriculture will be made for trace back investigation and sampling of suspected animals and/or the environment of the animals.

Surveys

Animals

Between 1997 and 2002 annual prevalence studies of VTEC in slaughter cattle were conducted. Since 2002, prevalence studies have been performed every third year. The aim is to detect a prevalence of 0.1% with a 90% confidence level. In each study, approximately 2000 cattle faecal samples are randomly selected from abattoirs representing about 90% of slaughtered cattle. A baseline study on cattle carcasses was done in 2006-2007 and a prevalence study in sheep was done at nine slaughterhouses in 2007-2008. Results from a slaughter prevalence study from 1998 showed that 0.1% of the pigs were positive.

Humans

Surveillance in humans is passive.

RESULTS

Animals

Active surveillance

During 2011 two cattle farms, three sheep farms and one farm with both cattle and sheep were epidemiologically investigated as suspected sources for human infection. VTEC O157 was isolated from one cattle farm and one sheep farm. VTEC O121 was isolated from one cattle farm. All other investigations were negative.

Monitoring

VTEC O157 was detected in 9 (1.8%) of 492 faecal and 2 (1.9%) of 105 ear samples from sheep in a survey performed in 2007-2008. In cattle, surveys during 1997-2002 showed a prevalence of approximately 1%. In the study done in 2005-2006, VTEC O157 was detected in 3.4% of faecal samples. In the abattoir survey conducted in 2008-2009 VTEC O157 was detected in 3.3% of 1,993 faecal and 8.2% of 500 ear samples (Map 9). In these studies, VTEC O157:H7 has predominantly been isolated from cattle in southern Sweden whereas very seldom from the northern two thirds of the country. However, in the latest survey, VTEC O157:H7 was isolated from one ear sample from Luleå, northern Sweden. This is the most northern isolate in the Swedish slaughterhouse surveys performed.

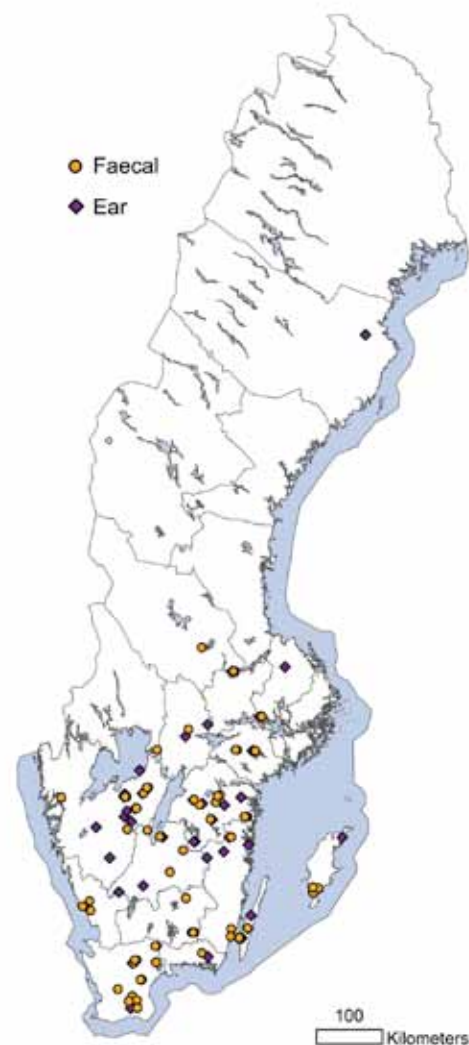
Food

Very few, approximately 30, samples were reported from the responsible authorities. The analytical methods used were either aimed at detection of O157:H7 or the genes of *eae*, *vtx1* or *vtx2*.

Humans

In 2011, 478 human cases were notified, the highest number reported since EHEC became notifiable in 1996. The unusual high number can be partly explained by the 53 cases reported in the German outbreak and another 20 cases reported in a Swedish outbreak during the year. Also, the number of sporadic domestic cases increased slightly in 2011.

Map 9. Geographical distribution of VTEC O157 positive faecal and ear samples collected at slaughter at the major slaughterhouses in a survey conducted during 2008/2009 in Sweden.





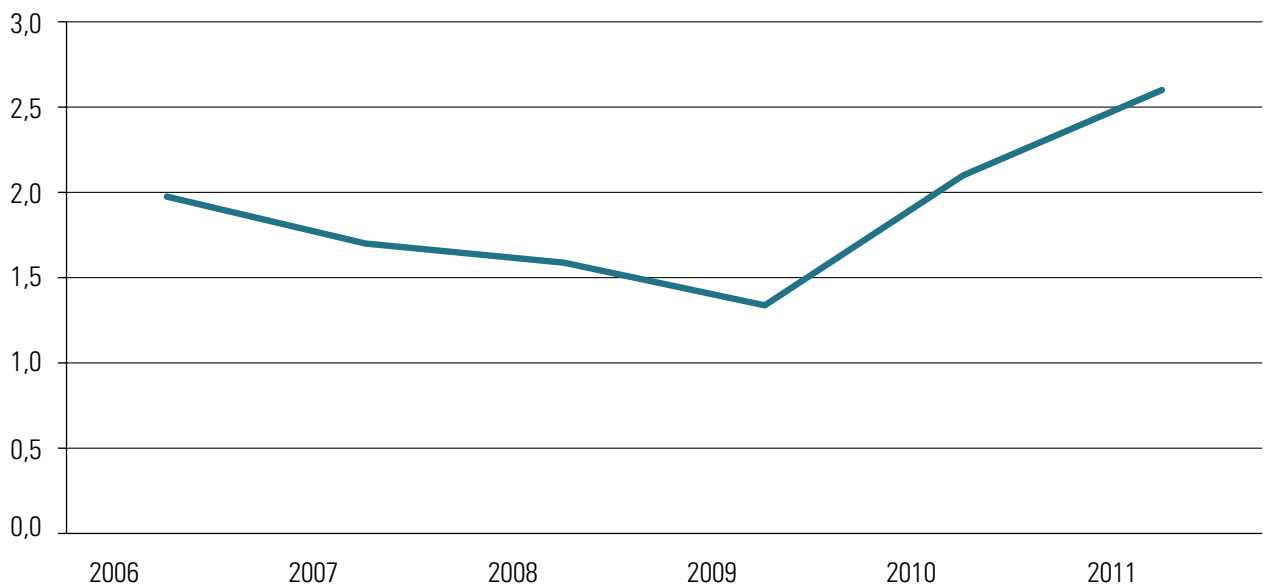
In 2011, 243 domestic cases were reported (51% of the total number, incidence 2.6 cases per 100,000 inhabitants), which is an increase from 2010 (194 cases). The observed trend shift from decreasing to increasing domestic incidence in 2010 thus continued (Figure 16).

Children under 10 years accounted for 35% of the domestic cases in 2011, which is a lower proportion than usually seen for EHEC (48% in 2010). The Swedish outbreak in the summer affected mainly adults which has influenced the age distribution in 2011. As in previous years, most domestic cases (24%) were in the age group of 1-4 years. A total of 24 cases of HUS were reported, eighteen of these belonged to the German outbreak. The other six cases were children or young adults below 20 years. Four were infected in Sweden and two abroad. Bacteria from four HUS cases could be isolated and three of these were O157:H7, verotoxin 2 producing.

The domestic incidence was highest in Jämtland (6.3 cases per 100,000 inhabitants) followed by Halland (6.0), Jönköping (5.0) and Västra Götaland (4.8). The counties in the southern part of Sweden usually have higher incidences partly due to screening of faecal samples from children diarrhoea for EHEC. The northern county Jämtland had an unusual high incidence as a cluster of 5 cases was reported in 2011.

Of the reported cases, 49% were infected abroad and Germany was the most common country of infection (n=60) followed by Egypt (38) and Turkey (37). Egypt is usually the country outside Sweden where most Swedes become infected with EHEC. Despite a decrease in travels to Egypt due to political instability, almost as many (n=38) cases of EHEC were reported in 2011 as in 2010 (n=40), which further highlights the high risk (cases per travels) of EHEC infection in Egypt.

Figure 16. Notified domestic incidence of human EHEC infection per 100,000 population in 2006-2011.



EHEC has a seasonal variation with most cases reported during the summer months. In 2011, 61% of the domestic cases were reported in June to September.

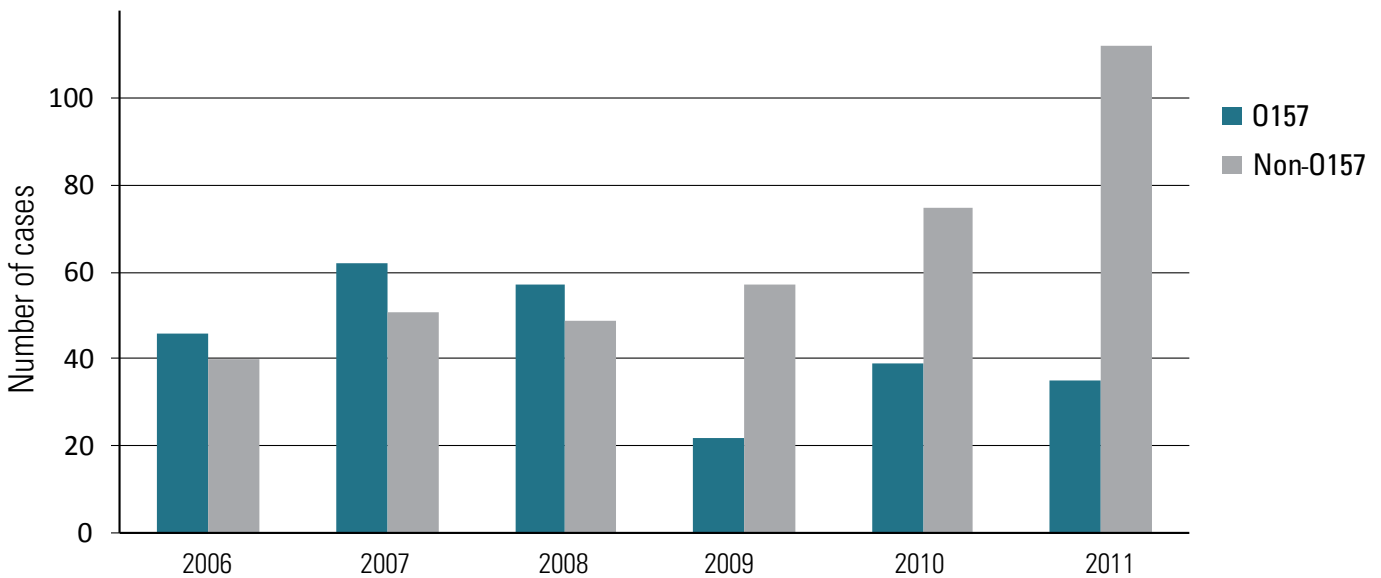
O157:H7 was the most common serotype among the domestic cases (34%). The serotype O104:H4 in the German outbreak was the most common among cases infected abroad (37%). After O157; O103 (20%), O26 (14%), O121 (11%), O Non Typable (7%), O91 (5%) and O145 (3%) were the most common serotypes among the domestic cases.

Domestic cases with O157 (n=35) slightly decreased from the year before (39 cases). The distribution of O157 and non-O157 has changed the last years. In 2011, three fourths of the reported cases were non-O157 and one fourth were O157. In the earlier years, O157 was more common than non-O157 (Figure 17). In 2011, the proportion of non-

O157 was unusually high which can be explained by the German outbreak (O104) and a Swedish outbreak (O103).

During May to July, the largest EHEC outbreak took place in Germany with 3,842 reported cases including 855 HUS cases and 53 deaths. The outbreak was caused by a rare ESBL producing, entero-aggregative E.coli (EAEC) with verotoxin producing characteristics, serotype O104:H4, thus with unusual properties. An extensive international investigation revealed contaminated fenugreek seeds from Egypt as the source of the outbreak. Travellers from several countries were infected and Sweden reported the highest number of cases outside Germany (n=53). All Swedish cases except one could be directly connected to Germany, either as travellers or through contact with a family member travelling to Germany. Eighteen (34%) of the 53 cases

Figure 17. Notified domestic human EHEC cases of O157 and non-O157 from 2006 to 2011.



developed HUS and one case died. The proportion of HUS was unusually high both in Sweden and Germany. Another remarkable observation was that all the Swedish cases were adults (over 20 years). Women were in majority (78%) among the Swedish HUS cases. The organism could be isolated and further typed from 48 of 53 cases. A continuous preparedness for rare serotypes such as the German one is crucial for a fast detection of outbreaks.

Shortly after the German outbreak, another outbreak caused by EHEC O103, occurred with 20 reported cases after participation in a summer camp in Östergötland. The participants came from different parts of Sweden. Most cases were aged 20-29 years. The symptoms were relatively mild most probably due to the outbreak strain producing only verotoxin 1. A cohort study among the participants at the camp indicated no increased risk associated with a specific food item, although several participants reported having been ill before the camp. Shared cooking might have caused the outbreak.

## DISCUSSION

In 2011, the incidence of EHEC was highest since the illness became notifiable. Apart from the outbreak cases in 2011, this might be partly explained by a possible increased awareness of EHEC among the public and within the health care system due to the media impact during the German outbreak. A decreasing trend in domestic EHEC infections was observed during previous years. However, in 2010, the domestic incidence increased which continued in 2011 with the highest number of notified cases since 2005. Several investigations were performed on suspected contaminated wells at summer cottages as well as suspected connections to farms. Most notifications in humans are in counties with higher cattle-density as well as with screening routines for faecal samples of children diarrhoea i.e. in southern Sweden. However, exceptions with higher numbers of cases are also annually reported for other counties.

The need for a continuous prioritisation of EHEC was highlighted by the large outbreak in Germany with serious consequences not only for the affected individuals but also for politics, economy, trade and food production in the countries directly or indirectly affected.

Because of modifications of the analytical methods, the results of the different prevalence surveys cannot be directly compared. Therefore it is difficult to determine whether the observed increase in animal prevalence from one to three percent is true or merely an effect of improved detection methods.

With a common goal to reduce the risk of EHEC cases there is cooperation between the responsible authorities. Studies are in progress to better understand the epidemiology and the underlying mechanisms of different sources of infection and the importance of different serotypes. One aim is to implement control measures to reduce prevalence of human pathogenic VTEC among cattle.

## REFERENCES

Beutin L, Martin A. Outbreak of shiga toxin-producing *Escherichia coli* (STEC) O104:H4 infection in Germany causes a paradigm shift with regard to human pathogenicity of STEC strains. *J. Food Protect.* (2012) 75, 408-418.

Frank C, Werber D, Cramer JP, Askar M, Faber M, an der Heiden M, Bernard H, Fruth A, Prager R, Spode A, Wadl M, Zoufaly A, Jordan S, Kemper MJ, Follin P, Muller L, King LA, Rosner B, Buchholz U, Stark K, Krause G, HUS Investigation Team. Epidemic Profile of Shiga-Toxin-Producing *Escherichia coli* O104:H4 Outbreak in Germany, *N. Engl J Med* 2011; 365:1771-1780..

Ivarsson S, Jernberg C, Björkholm B, Hedenström I, Lopez G, Regional Investigation Team, Rapid detection and communication of Swedish cases provided early puzzle pieces in the German STEC O104 outbreak, poster Escaide conference 2011.

Sartz L, De Jong B, Hjertqvist M, Plym Forshell L, Alsterlund R, Löfdahl S, Osterman B, Ståhl A, Eriksson E, Hansson H-B, Karpman D. An outbreak of *Escherichia coli* O157:H7 infection in southern Sweden associated with consumption of fermented sausage; aspects of sausage production that increase the risk of contamination, *Epidemiol. Infect.* 2008; 136: 370-380.

Söderström A, Österberg P, Lindqvist A, Jönsson B, Lindberg A, Blide Ulander S, Welinder-Olsson C, Löfdahl S, Kaijser B, De Jong B, Kühlmann-Berenzon S, Boqvist S, Eriksson E, Szanto E, Andersson S, Allestam G, Hedenström I, Ledet Muller L, Andersson Y, A large *Escherichia coli* O157 outbreak in Sweden associated with locally produced lettuce, *Foodborne Pathog. Dis.*, Vol 5, Nr 3 2008.

National guidelines: Handlingspolicy avseende kontroll av verotoxinbildande *Escherichia coli*. Available from: [http://www.smi.se/upload/Publikationer/VTEC\\_5GD\\_080520.pdf](http://www.smi.se/upload/Publikationer/VTEC_5GD_080520.pdf)

# West Nile Fever

## BACKGROUND

West Nile virus, a vector-borne virus with zoonotic potential; belongs to the genus flavivirus. Birds are considered the main reservoir host, and the role of non-avian mammals and reptiles in the infectious cycle is yet to be established. Through mosquitoes, the virus can infect humans and horses but both are considered as 'dead end hosts' with an insufficient viraemia to further facilitate the spread. West Nile virus was first isolated from a woman in Uganda in 1937. Today it is spread through Africa, parts of Europe, Russia, Asia and Australia. In 1999 the virus was introduced to North America and rapidly spread over the continent causing large number of deaths in both horses and humans. West Nile virus is now well established through North America, including Canada, and parts of Central America and northern South America.

## DISEASE

### Humans

Most infected patients are asymptomatic. About 20% will develop West Nile Fever characterized by fever, malaise, weakness, headache and body aches. Anorexia, lymphadenopathy, nausea, diarrhea, vomiting, sore throat and conjunctivitis may also be seen. A small proportion of patients with West Nile Fever develop West Nile neuroinvasive disease. This form can be severe, and in some cases, it is life-threatening. Three syndromes - encephalitis, meningitis and acute flaccid paralysis - are seen.

### Animals

In North America a prominent feature of the infection is high mortality in birds. This is rarely seen in European outbreaks. Horses can be infected and develop clinical illness, but like in humans, many remain asymptomatic. Some horses will show general illness with depression, fever and anorexia. A somewhat larger proportion of horses compared to humans will show signs of neurological disease with ataxia, hyper excitability, face- and neck tremors, circling and in severe cases recumbency and death.

## LEGISLATION

### Animals

West Nile Fever falls under the Swedish Act of Epizootic diseases (SFS 1999:657 with amendments) and is notifiable on clinical suspicion.

### Humans

West Nile Fever is notifiable as a viral meningoencephalitis according to the Communicable Disease Act (SFS 2004:168).

## SURVEILLANCE

### Animals

In 2011, 62 dead predator birds sent for autopsy were analysed. Tissue samples including kidney and central nervous system were used for PCR analysis. Further, 70 broilers from seven outdoor holdings were tested for antibodies to West Nile virus. Four horses with meningitis/meningoencephalitis were examined.

### Humans

The disease has never been diagnosed in Sweden.

## RESULTS

### Animals

All the tested birds, broilers and horses were negative for West Nile virus.

### Discussion

Symptoms of West Nile Fever in animals precede human cases. It is essential to establish an active animal health surveillance system to detect new cases in birds and horses, particularly in endemic areas to provide an early warning for veterinary and human public health authorities. Vaccine is available for horses, but not for humans. To protect horses from disease, vaccination is often used in endemic areas, such as in Italy and North America. As for most vector borne diseases, care should be taken to minimize the exposure to mosquito bites. Measures to eliminate standing water, serving as mosquito breeding grounds, should be taken and in some regions vector control could be applied.

# Yersiniosis

## BACKGROUND

The genus *Yersinia* has been associated with human and animal diseases for centuries. Two enteropathogenic species of the bacterial genus of *Yersinia* are zoonotic, namely *Yersinia enterocolitica* and *Yersinia pseudotuberculosis*. Pigs are considered the main reservoir of *Y. enterocolitica*. *Yersinia* bacteria are widespread in nature but nonpathogenic strains are common. The most common human pathogenic variant is *Y. enterocolitica* 4/O: 3.

Wild animals, especially rodents and birds are considered the principal reservoir of *Y. pseudotuberculosis*. Both *Y. enterocolitica* and *Y. pseudotuberculosis* are frequently found in pig tonsils and intestinal contents. Infections caused by *Y. enterocolitica* are thought to be food-borne. The sources and vehicles of *Y. pseudotuberculosis* infections in humans remain obscure but infections caused by consumption of contaminated carrots and iceberg lettuce have been described. *Yersinia* bacteria are destroyed by heating (pasteurization and cooking) but are able to grow at low temperatures and can therefore grow in food that is kept cool.

*Y. pseudotuberculosis* was isolated from diseased guinea pigs in the 1880's. Mainly sporadic cases of yersiniosis were reported in humans until a large outbreak of *Y. enterocolitica* associated with chocolate milk occurred in the USA in 1976. The first food- and waterborne outbreaks of *Y. pseudotuberculosis* were reported in 1980's.

## DISEASE

### Animals

Pigs are asymptomatic intestinal carriers of pathogenic *Y. enterocolitica* and *Y. pseudotuberculosis*. Infection with *Y. pseudotuberculosis* in other animals may vary from asymptomatic to severe mesenteric lymphadenitis and lead to septicaemia and death.

*Y. enterocolitica* has occasionally been isolated from cats and dogs with diarrhoea.

### Humans

*Y. enterocolitica* causes gastrointestinal symptoms in humans ranging from mild self-limiting diarrhea to acute mesenteric lymphadenitis, which might be difficult to differentiate from appendicitis. Long-time sequelae including reactive arthritis, uveitis and

glomerulonephritis occur sometimes. Prolonged carriage has been reported in children as well as in adults.

## LEGISLATION

### Animals

*Y. enterocolitica* and *pseudotuberculosis* are not notifiable in animals.

### Food

*Y. enterocolitica* and *pseudotuberculosis* are not notifiable in food.

### Humans

Yersiniosis is notifiable according to the Communicable Disease Act (SFS 2004:168).

## SURVEILLANCE

### Animals

There is no active surveillance in animals.

### Food

There is no active surveillance in food.

### Humans

The surveillance is passive in humans.

## RESULTS

### Animals

*Y. enterocolitica* serotype O:9 was isolated from one sheep farm tested at the SVA after positive serological reaction in the *Brucella* control program.

A study was performed to investigate the role of sheep as carriers for human pathogenic *Y. enterocolitica*. In September 2010 through January 2011 tonsil and faeces samples from 99 sheep slaughtered at Gotland were analysed. No human pathogenic *Y. enterocolitica* isolates were found.

### Food

Hardly any samples were reported from official sampling.

### Humans

Yersiniosis is mainly a domestic infection. In 2011, 350 cases were reported (Figure 18). Of these, 256

cases (73%) were reported as domestic, 21% as imported and for 6% the country of the infection was not stated. Of the 72 cases infected abroad 10 cases were reported as infected in Spain, 9 in Turkey, 5 in Greece and 4 in Thailand and Austria respectively, from other countries only a few cases were reported.

During the years 2000- 2004, the number of domestic cases of yersiniosis increased until 2004 when 594 domestic cases were reported. Since then, the number of cases has decreased. In 2010, the lowest number (n=219) of domestic cases since 1997 was reported. However, the number of domestic cases increased with 16 % in 2011. A trend analysis was performed including all the domestic cases of 2004-2011 and cases in children younger than 1 year and in the ages of 1-6 years. For all investigated age groups a statistical significant downward trend was seen except for children younger than one year.

In 2011, a majority of the domestic cases was young children and 30 % of them were 0-4 years. The number of children younger than 1 year was 19 in 2011 compared to 8 in 2010. Most cases were reported in the summer, between June and August (120 cases).

DISCUSSION

Yersiniosis is one of the most notified zoonoses in Sweden. Since 2004, the number of notified yersiniosis cases in humans has decreased. This decrease has occurred without any active measures in the food chain. However, the number of domestic cases increased last year. The reasons for this fluctuation are not elucidated. In order to raise awareness of yersiniosis a national symposium was organised in 2011.

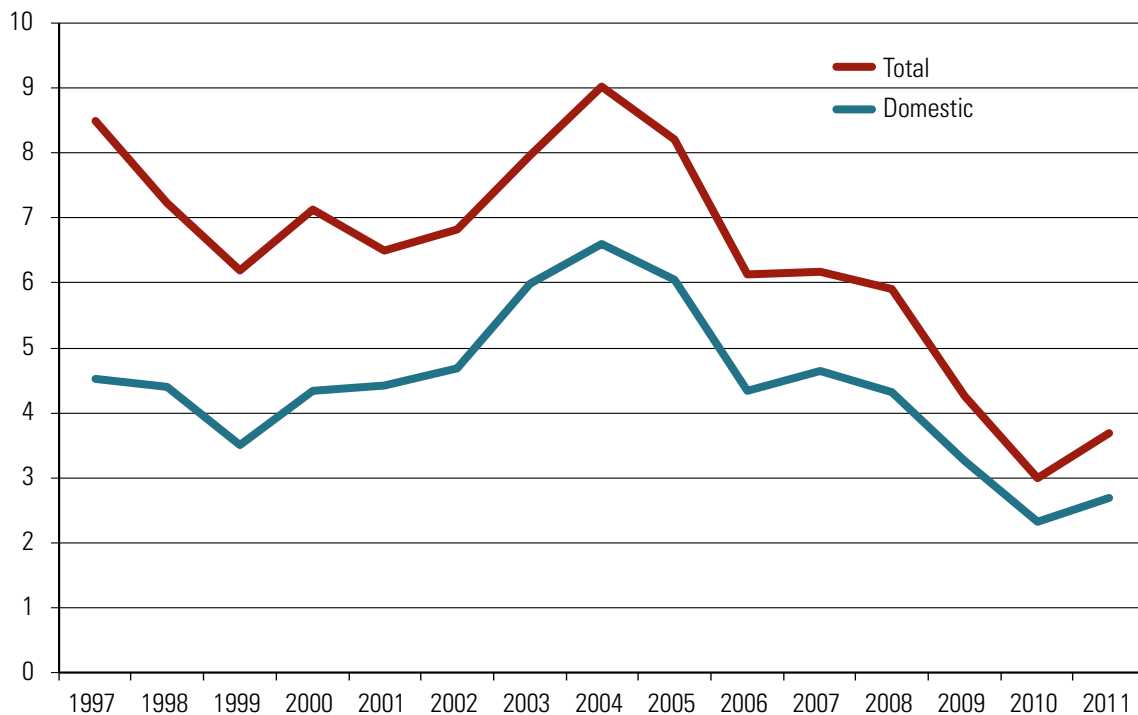
Yersiniosis in humans is considered foodborne. Outbreaks are rare and most infections seem to be sporadic but under-reporting may be considerable. Approximately 70-75% % of the infected cases are domestic. Case-control studies suggest consumption of pork products as a risk factor. Good slaughtering hygiene and good manufacturing practice in food processing are essential in controlling *Yersinia*.

REFERENCES

Boqvist S, Pettersson H, Svensson A, Andersson Y Sources of sporadic *Yersinia enterocolitica* infection in children in Sweden, 2004: a case-control study. *Epidemiol Infect.* 2009;137(6):897-905

Lindblad M, Lindmark H, Thisted Lambertz S, Lindqvist R. Microbiological baseline study of swine carcasses at Swedish slaughterhouses. *J Food Prot.* 2007;70(8):1790-7.

Figure 18. Notified incidence (per 100,000) of human yersiniosis in Sweden, 1997-2011.



# **Additional surveillances 2011**



# Poultry Health Control Program

## BACKGROUND

The Poultry Health Control Program is based on provisions (SJVFS 2010:58) issued by the Swedish Board of Agriculture. The program is mandatory for all hatcheries producing more than 50,000 day-old chickens per year and all breeding establishments (grandparent and parent flocks of layers, broilers and turkeys) delivering hatching eggs to these hatcheries. In addition to serological sampling for several infectious diseases the program consists of rules on biosecurity, standard of the houses, management, clinical surveillance etc.

## LEGISLATION AND DISEASE

All diseases in the program are notifiable according to provisions issued by the Swedish Board of Agriculture (SJVFS 2002:16 with amendments). The diseases included in the program during 2011 are briefly described below.

- *Salmonella Gallinarum* (causing Fowl typhoid) and *Salmonella Pullorum* (causing Pullorum disease) are specially adapted to poultry. Both serotypes are included in the Swedish zoonosis legislation as well as in the European legislation on trade in poultry and hatching eggs (Council Directive 2009/158/EC). These two salmonella serotypes were eradicated from the Swedish commercial poultry population in the beginning of the 1960's. *S. Gallinarum* has not been detected in Swedish poultry since 1984 when a backyard flock was found to be infected. *S. Pullorum* was last detected in two backyard flocks in 2001. Both serotypes are important vertical infections in addition to the common horizontal spread. *S. Gallinarum* commonly infects and causes disease (diarrhoea, inappetence, production losses and mortality) in older birds. Pullorum disease mainly affects fetuses and chickens up to 3 weeks of age.
- *Mycoplasma gallisepticum* and *Mycoplasma meleagridis* are important poultry pathogens, *M. meleagridis* is however only pathogenic for turkeys. These two mycoplasmas are able to spread both horizontally and vertically. They mainly cause respiratory disease and egg production losses. *M. gallisepticum* may also cause arthritis and is present in the backyard poultry population in Sweden. Testing of breeding flocks for *M. gallisepticum* and *M. meleagridis* (only turkey flocks) is included in the European legislation on trade in poultry and hatching eggs (Council Directive 2009/158/EC).
- Paramyxovirus type 1 may cause outbreaks of Newcastle Disease, with egg production losses, increased mortality, nervous signs and respiratory symptoms, the severity of the disease may however vary. The virus is transmitted through direct and indirect contacts with infected birds and for shorter distances also with the wind. Wild birds are an important reservoir. Since 1995, eleven outbreaks of Newcastle Disease have occurred in Sweden. The disease is included in the Swedish Act of Epizootic diseases (SFS 1999:657 with amendments). Since all outbreaks have been successfully eradicated Sweden is keeping its status as a Newcastle free country without vaccination according to Commission Decision 95/98/EEC.
- Egg drop syndrome – virus is a naturally occurring adenovirus in water fowl (including the wild population) in which it does not cause any symptoms. In chickens, symptoms are only seen during the production period as decreased egg production in an otherwise clinically healthy flock. The virus is able to spread both vertically and horizontally. The Swedish breeding population is free from the disease.



**SURVEILLANCE**

The serological screening within the program is administered by SVA and financed by the Swedish Board of Agriculture and the participating companies. In 2011 nine different breeding companies participated in the program; four broiler-, three laying hen- and one turkey breeding company. In accordance with the provisions, sixty blood samples were taken from the breeding flocks included in the program, once during the rearing period and several times during the production period. The blood samples were sent by mail to the National Veterinary Institute (SVA) where serological tests were performed. The sampling and testing schemes are presented in Tables 13 and 14.

**RESULTS**

Table 15 gives an overview of all samples taken in breeding flocks of chickens and turkeys, and the laboratory methods used, during 2011. All analyzed samples tested negative for *Salmonella Gallinarum*, *Salmonella Pullorum*, *Mycoplasma gallisepticum*, *Mycoplasma meleagridis* and Paramyxovirus type 1.

During 2011, five chicken flocks (two grandparent and three parent flocks) were further investigated due to a few positive samples for Egg drop syndrome. No clinical signs were seen in these flocks and after testing new samples from these flocks, the previous positive samples were considered as unspecific serological reactions.

**DISCUSSION**

The aim of the Poultry Health Control program is to document freedom from the diseases included, to stop the introduction and possible further spread of diseases and to allow trade from the participating companies.

The results from the serological screening in the Poultry Health Control Program support the status of freedom from these infections in the Swedish breeding poultry population. However, the clinical surveillance of the poultry breeding population is also of utmost importance.

Table 13. Sampling schedule for chicken grandparent and parent flocks. Number of blood samples tested at different weeks of age.

<b>Agent</b> \ <b>Age in weeks</b>	<b>16</b>	<b>24</b>	<b>36</b>	<b>48</b>	<b>60</b>
<i>S. Pullorum/ S. Gallinarum</i>		60			
<i>Mycoplasma gallisepticum</i>	60	60	60	60	60
Paramyxovirus type 1				60	
Egg drop syndrome-virus		30			

## ADDITIONAL SURVEILLANCES 2011

Table 14. Sampling schedule for turkey parent flocks. Number of blood samples tested at different weeks of age.

<b>Agent</b>	<b>Age in weeks</b>	<b>20</b>	<b>32</b>	<b>44</b>	<b>56</b>
<i>S. Pullorum/ S. Gallinarum</i>			60		
<i>Mycoplasma gallisepticum</i>		60	60	60	60
<i>Mycoplasma meleagridis</i>		60	60	60	60
Paramyxovirus type 1					60

Table 15. Number of sampling occasions for grandparent (GP) and parent (P) flocks of chickens and turkeys and total number of samples tested.

<b>Disease</b>	<b>No of sampling occasions</b>			<b>No of samples</b>			<b>Method</b>
	Chickens		Turkeys	Chickens		Turkeys	
	GP	P	P	GP	P	P	
<i>S. Pullorum /S. Gallinarum</i>	9	81	4	540	4 860	240	Rapid plate agglutination
<i>Mycoplasma gallisepticum</i>	42	435	16	2 520	26 100	960	ELISA Svanovir MG antibody test, SVANOVA
<i>Mycoplasma meleagridis</i>	0	0	16	0	0	960	Rapid plate agglutination
Paramyxovirus type 1	9	90	4	540	5 400	240	NDV screen competition ELISA, ID.Vet
Egg Drop Syndrome-virus	9	81	0	270	2 430	0	Haemagglutination inhibition test

# Infectious diseases in wild boars

## BACKGROUND

Contagious pig diseases in general and classical swine fever in particular can affect and be spread by the wild boar population. This has been the situation in several European countries. The wild boar population is increasing in Sweden and is estimated by the Swedish environmental protection agency to be more than 100,000 heads. Since year 2000 more than 2,000 dead hunted wild boars from different parts of the country have been bled in connection to slaughter. The samples have been sent to National Veterinary Institute (SVA) for analysis for antibodies to certain infections.

## LEGISLATION

The infections in the wild boar surveillance program 2011 are all included in the Swedish Act of Epizootic diseases (SFS 1999:657 with amendments) and are notifiable on suspicion. If any of them are suspected or confirmed, measures will be taken to control the disease and to prevent further spread.

## SURVEILLANCE

In 2011, 342 blood samples from wild boars from different parts of Sweden were analyzed for antibodies to Aujeszky's disease (AD) virus, porcine reproductive and respiratory syndrome (PRRS) virus, African swine fever (ASF) virus and classical swine fever (CSF) virus. The samples were analyzed for antibodies to ADV and PRRSV using the methods described under the respective disease headings in this report. Antibodies to CSF and ASF were analyzed using commercial ELISA-methods (IDEXX® HerdChek CSFV Antibody Test Kit, IDEXX, Sweden and Ingezim PPA COMPAC 11.PPA.K.3, Ingenasa, Spain, respectively)

## RESULTS

The geographical distribution of sampled wild boars was roughly correlated to the distribution and density of the wild boar population. All samples tested were serologically negative.

## DISCUSSION

The Swedish wild boar population is growing and the boundaries for its presence in the Swedish fauna moves further north. In areas where wild boars already are present the population becomes denser, which increases the risk of direct or indirect contact between wild boars and domestic pigs. With the increasing population, hunting wild boar becomes more popular and foreign hunters come to Sweden to hunt and Swedish hunters go abroad. These hunting travels may pose an increased risk of introducing exotic diseases into Sweden as people have direct or indirect contacts with wild animals that may be infected. There is also a risk that wild boar may be infected by eating infected meat that is brought in to Sweden illegally and dumped for some reason. Once the wild boars are infected there is a possibility that they will spread the disease to domestic pigs.

# Infectious diseases in fish and shellfish

## BACKGROUND

Sweden has a very healthy aquaculture as well as wild populations of fish and shellfish. None of the serious diseases that occur through Europe are found in Sweden. The diseases that occur are of lower importance and occur at low frequencies. The reason for this is to be found in the history of Swedish aquaculture. A restrictive approach to the importation of live fish for restocking/farming was an important part as well as an early introduction of health-control in farms. To maintain this good state of health, a comprehensive epidemiological thinking is required as fish and shellfish are included in several multifaceted activities related to each other with the risk of spreading diseases. Other considerations such as ballast water, shipping, sport fishing, ornamental/aquarium fish and migrating wild fish play a significant role in the assessment and management of the health protection for the animal species.

Most Swedish rivers have dams in their reaches due to hydropower stations. These are very effective migration barriers for feral fish and are of a great help to protect the water upstream from existing and emerging coastal diseases. This gives a different health situation at the coast compared to the more disease free continental zone. To maintain this situation all transport of live fish from the coast to the continental zone is forbidden. Due to the migration barriers Sweden has a national conservatory program for salmonids. Migrating brood fish are caught at the first barrier and kept until ready to spawn. In connection with stripping, the fish are sampled for virus and renibacteriosis/BKD. After fertilization and disinfection the eggs are placed in quarantine and kept there until the results from the tests are available. The quarantines are supplied with water from the continental zone and outlets are made to the coast. All eggs from positively tested parents are destroyed. After hatching and rearing, in freshwater emanating from the continental zone, the offspring are released to the coastal zone.

Sweden has an approved disease free zone status (2002/308/EC) for Viral hemorrhagic septicaemia (VHS) and Infectious hematopoietic necrosis (IHN)

(2008/427/EG). Also, additional guaranties are received for the whole country for Spring Viremia of Carp (SVC) and for the continental zone for Infectious Pancreatic Disease (IPN) (2010/221/EC). The continental zone of Sweden has an EU accepted eradication program for BKD and the coastal zone for IPN (2010/221/EU). Sampling and diagnostics for these diseases have encompassed all Swedish fish farms since the late 80ies, and are performed according to EU directive 2001/183 and 2006/88.

## DISEASE

Infectious hematopoietic necrosis (IHN) and viral haemorrhagic septicaemia (VHS)

Both diseases are caused by rhabdovirus and occur frequently in Europe. They are transferred horizontally, and a vertically transmission cannot be completely ruled out for IHN. VHS is found in a marine form, why a low presence in wild populations of sensitive species, cannot be excluded in the coastal zone.

Both diseases have greatest impact in aquaculture of rainbow trout (*Oncorhynchus mykiss*) in freshwater, but has also been detected in several other species. For both diseases the fish exhibit behavioural changes, lethargy and abnormal swimming (whirling). The fish are anaemic with varying degrees of bleeding in multiple organs. Therapy and vaccines are lacking.

Infectious pancreatic necrosis (IPN)

IPN is caused by a virus associated to the group Birnaviridae. The virus is highly infectious to juvenile salmonids but the sensitivity declines with increasing age. Fish that survive the virus infection become asymptomatic virus carriers. In addition to the salmonids virus has been detected in several other species. Infection can be transmitted both horizontally and vertically. The disease is considered as one of the most economically costly in several European countries. The disease has greatest consequences, with high mortality in young fish. The symptoms are mainly external symptoms such as darkening and abdominal distension. Corkscrew swimming is char-



acteristic. Bleeding in the abdominal fat and internal organs are the most dominant inner findings. Mortality rates can vary between 10-90%.

#### Renibacteriosis (BKD/*Renibacterium salmoninarum*)

BKD is caused by a gram positive, small rod *Renibacterium salmoninarum*.

The infection can be transmitted both horizontally and vertically. The disease is favoured by low water temperatures, which is why outbreaks occur mainly during spring and fall at temperatures between 7-15 degrees.

In rainbow trout the disease can be characterized as chronic and provide a continuous low mortality of about 5-10%. Infected fish may have a reduced growth and disease can result in a deterioration of quality of fish for human consumption. Salmon and arctic char, however, are more susceptible to BKD, especially in situations of stress, and mortality can reach up to 80%.

#### Spring viraemia of carp (SVC)

SVC is caused by a rhabdovirus. The disease occurs in Asia and several European countries. The virus has been detected in several fish species in the cyprinid family. The disease is transmitted only horizontally.

The symptoms of the disease are usually general, such as darkening, exophthalmia and a slow breathing. The fish swim lazily by sporadic periods of hyperactivity. Common findings are also pale gills, a distended abdomen with ascites and small hem-

orrhages in the skin and gills. Internally bleeding is found in organs including muscle, swim bladder and brain.

#### Marteiliosis

Marteiliosis is caused by a unicellular parasitic animal (*Marteilia refringens*). The parasite need a crustacean (*Paracartia grani*) as an intermediate host, a species considered not to exist in Sweden due to the climate. The disease causes reduced fitness, an impaired growth and resorption of the gonads and hence reduced reproductive capacity. When the animals weaken they will have difficulties to keep the shell halves closed. The parasite is considered to exist in two forms the "o" and "m" form, whereby the first-mentioned is demonstrated in the oyster and the latter in blue mussels.

#### The crayfish plague

Crayfish plague is caused by an aquatic fungus parasite, (*Aphanomyces astaci*), which in late 1800 spread to Europe from the U.S. with live crayfish. The disease occurs throughout Europe and North America. The parasitic fungus reproduces by spores spread by water. When the spores find a crayfish they grow through the skin and attack the underlying tissues.

The signal crayfish – exhibit black (melaninated) areas in the shell adjacent to the presence of the fungus in the skin. The spots will disappear in the shedding of the shell, but may gradually come back.

The noble crayfish – the first sign is a high mortality in the crayfish populations. In the individual

you find mainly behavioral symptoms such as moving during daytime, reduced coordination and balance difficulties.

In connection with investigations relating to crayfish plague, an examination for white spot disease (WSD) is performed.

### LEGISLATION

All the diseases except crayfish plague are included in the Swedish legislation regarding notifiable diseases (SJVFS 2002:16) and the control is specifically regulated in SJVFS 1994:94. Further, IHN, VHS, IPN (other than serotype ab) and SVC are included in the Swedish Act of epizootic diseases (SFS 1999:657). Crayfish plague is regulated by The Swedish Agency for Marine and Water Management (SwAM) a new government authority which replaces the old Board of Fishery.

### SURVEILLANCE

Sweden has two control programs: a national compulsory and a voluntary one.

The aim of the programs is to document freedom from IHN, VHS, IPN, BKD and SVC in the Swedish fish population and to contribute to the maintenance of this situation. The programs also provide an opportunity for early detection of new, exotic diseases, thereby improving the conditions of control. The national compulsory program is regulated by EU directive 2006/88 and the Swedish Board of Agriculture. Practically it is performed by the Swedish Fish Health Control, the health organisation of the aquaculture industries. The program prescribes inspections and sampling for virus and renibacteriosis (BKD/*Renibacterium salmoninarum*) based on the risk for the farm to obtain infection, spread it and the impact of the agent. For each farm a risk analysis is done, forming the basis for classification and hence the number of visits and samples to be performed in the farm. The inspections are to be performed at a water temperature that is optimum for searched agent.

The voluntary program prescribes an additional inspection at a water temperature of over 14°C, and a yearly sampling for BKD in farms with breeding program.

The National Board of Fisheries implements the control of crayfish for crayfish plague (*Aphanomyces astaci*). White spot syndrome (WSS) is considered a high risk disease for Sweden due to the risk for transmission to wild populations of *Crustacea* through angling. The disease is not included as an active target in the Swedish control program but incoming samples of crayfish are routinely tested.

As well as during 2010, Sweden also conducted a screening of (*Marteilia refringens*) during 2011. The study was this year conducted on oysters at the Swedish west coast in both farms and wild populations.

All diagnostic analyses are performed at the Swedish reference laboratory, the National Veterinary Institute (SVA).

All analyses are performed according to recommendation by EU or OIE.

Viruses in fish are tested on pooled organ material (spleen, kidney, heart/brain) by a cell culturing method. A pool consists of organs from up to ten fishes, cultivated in live cell lines and identified by serum neutralisation, ELISA or in some cases PCR.

BKD is demonstrated by an ELISA method or cultivating and verified by PCR.

The crayfish plague are demonstrated by light microscopy, cultivating and verified by PCR, and WSD by PCR.

### RESULTS

Viral haemorrhagic septicaemia (VHS), Infectious hematopoietic necrosis (IHN), Infectious pancreatic necrosis (IPN)

During 2011, 548 pools of samples were tested, equal to approximately 5,000 individuals from both continental and coastal zone.

#### Spring Viremia of Carp (SVC)

In 2011, 9 pools, equal to approximately 30 – 90 individuals.

No positive case of the here mentioned epizootic viruses was detected during 2011.

#### Bacterial Kidney Disease (BKD)

Kidneys from 2902 fish were tested.

One positive sample was found.

#### Koi-herpes (KHV)

Samples from 245 fish from 11 locations was tested. One location tested positive.

#### *Marteilia refringens*

150 samples of oysters (*Ostrea edulis*) from two farms and three wild populations from the Swedish west coast were tested. Of these, three tested positive.

#### Crayfish plague

The disease was investigated in 11 cases from 10 different locations.

Disease-causing agents in general detected during 2011 were one pike that tested positive for *Yersinia ruckeri* and one fish farm that tested positive for parasitic kidney disease (PKD).

#### DISCUSSION

The animal health in Swedish aquacultures is still of high quality and all severe diseases of importance are absent. The most problematic disease to control is renibacteriosis/BKD, due to its vertical transmission and “sneaky” appearance. This is expected to be resolved by modified sampling and improved methodology. Additional resources must be invested in the risk based-based analysis of individual aquacultures farms to get a more reliable assessment for health surveillance.

# Post mortem examinations in food producing animals

## BACKGROUND

Early detection of infectious diseases is of outmost importance in order to mitigate negative effects. For diseases with severe clinical signs the first line of defense is the detection of disease by animal owners, field veterinarians or pathologists. International experiences as well as practical examples from Sweden shows that post mortem examinations remain a vital part in disease control and that emerging diseases many times have been detected at post mortem examinations. This was for example the case when PMWS was introduced to Sweden in 2003, and in 2008 when anthrax was diagnosed for the first time since 1981.

As post mortem examinations are considered an important part in the early detection and national surveillance for infectious and emerging disease, after decades of decreasing numbers of post mortem examinations in food producing animals, a specific program for encouraging such examinations by financial means started in the early nineties. The Swedish Board of Agriculture finances the program and the Swedish Animal Health Services (SvDHV) is responsible for the organization.

## PROGRAM

The program finances post mortem examinations in all food producing animals including poultry, which was included in the program 2007. Since 2008 also exotic domesticated hoof animals are included. In addition to post mortem examinations samples are collected from defined categories of animals for salmonellosis, paratuberculosis, PRRS, CSF, brucellosis, TSE and antibiotic resistance. Since 1999 approximately 3,000 animals have been examined yearly within the program.

The program also includes further education of the veterinary employees at the post mortem facilities; yearly courses are held and quarterly newsletters are produced.

Transportation of the carcasses to the laboratories is arranged and financed by the owner, which with large animals can be a problem particularly when the distance between the farm and post mortem facility is long.

## RESULTS

During 2010 post mortem examinations were performed at five different sites throughout the southern part of the country; Skara (Eurofins), Kristianstad (Eurofins), Uppsala (SVA and SLU), Visby (SvDHV In cooperation with Swedish Meats) and Karlskoga (DVO in cooperation with SvDHV and Konvex). Large animals, such as adult cattle, could be examined at four of these sites; Uppsala, Visby, Kristianstad and Karlskoga. A total of 2,796 post mortem examinations were performed within the program. The distribution between species is shown in Table 16. In 2010, 207 cases were diagnosed with a notifiable disease. Table 17 shows the reported primary cases of notifiable diseases. Not all of them have gone through a post mortem examination. In 2011 an outbreak of anthrax in cattle occurred in the county of Örebro. The primary case was detected in a post mortem examination at SVA.

The results from post mortem examinations cover the year of 2010.

## DISCUSSION

As well as being a vital part of the national surveillance for infectious and emerging diseases, as illustrated by the detection in 2010 of 207 index cases of notifiable diseases, and in 2011 of a case of anthrax. Post mortem examination is furthermore an important tool for the individual farmer in solving animal health problems at the farm. The last decade the number of post mortem examinations have been around 3,000 per year, and stayed close to this number in 2010 also.

During 1998-2001 the number of examinations performed on different species did not correlate to the size of the population in each region (Wahlström 2003). Most cattle, sheep and swine underwent post mortem examination in the Uppsala region whereas the biggest populations are present in the southern parts of the country. A regional imbalance can still be seen in that more examinations are performed in the relatively few regions with close proximity to post mortem examination facilities, but the number of examinations is highest in regions having high



animal density in addition to access to a regional laboratory performing post mortem examinations.

Vicinity to facilities where post mortem examinations can be performed is also important for quality reasons, as long time before cooling of the body will result in higher degree of cadaverous changes and will thus have impact on the quality of the examinations.

A 3-years study on the national surveillance of infectious diseases will start in 2012 and will take into account the possibilities of increasing the sensitivity in the surveillance by using post mortem investigations on fallen stock. This will also increase the possibilities of early detection of newly introduced infectious diseases.

#### REFERENCES

Wahlström, H. 2003. Sjukdomsövervakning hos animalieproducerande djur – en översyn på uppdrag av Jordbruksverket och Köttböndernas Forskningsprogram.

Redovisning av uppdrag om veterinär obduktionsverksamhet.veterinär obduktionsverksamhet (SJV Dnr 33-10225/10)

Table 16. Number of post mortem examinations in food producing animals performed during 2010.

Species	Total in 2010
Swine	932
Cattle	773
Sheep	637
Goat	24
Farmed deer	12
Poultry	391
Exotic ungulates	25
Other	2
<b>Total</b>	<b>2796</b>

Statistics from Swedish Animal Health Services.

Table 17. Number of diagnosed cases with a notifiable disease 2010.

Disease	Index case
Leptospirosis	1
Q-fever	6
Listeriosis	36
Blackleg	6
Botulism (poultry)	2
Lymphoma (not EBL)	75
VTEC/STEC	1
Salmonellosis	27
MRSA (pig)	1
Cysticercosis	2
Bovine Malignant Catarrhal fever	6
Bovine Viral Diarrhoea	1
Avian tuberculosis (poultry)	1
Infectious laryngotracheitis	6
Caprine Arthritis Encephalitis	9
Dichelobacter nodosus	22
TSE, Nor98	4
Nematodirus battus	1
<b>Total</b>	<b>207</b>

Statistics from Swedish Board of Agriculture.

# Post mortem examinations in wildlife

## BACKGROUND

A passive surveillance program for diseases of wildlife based on pathology and ancillary testing was established in Sweden in the 1940s. The surveillance program is funded by governmental funds managed by the Environmental Protection Agency, making the examinations free of charge for the submitters. An active disease surveillance program for wildlife was established in 2006 in order to follow up and define present and emerging diseases in Swedish wildlife.

## SURVEILLANCE

The general public, local authorities and hunters can submit wildlife that is found dead or euthanized to the National Veterinary Institute (SVA) for examination. Around 2,000 wildlife cases (bodies or parts of animals) are received each year. The aim of the passive and active wildlife disease surveillance programs is to monitor the health situation in wildlife in Sweden. Whenever possible, disease-causing agents are identified. The disease surveillance and diagnostics provide key information for wildlife management, is part of zoonotic and epizootic disease control efforts and can serve as indicators of environmental and ecosystem health.

The National Veterinary Institute is the only laboratory in Sweden where post mortem examinations of fallen wildlife is performed. An annual report summarizes the disease events and results of the disease surveillance programs for the past year, and is published (so far only in Swedish) on [www.sva.se](http://www.sva.se). SVA is the national wildlife focal point for OIE and submits half-year and annual reports of diagnosed wildlife diseases listed by the OIE.

## RESULTS

In 2011, about 5,500 wild animal samples were submitted to the Department of Pathology and Wildlife Diseases at SVA. This includes fallen wildlife, parts of fallen wildlife, lesions found in game animals, and standard samples collected from hunted large carnivores or other hunted game species. Wild boar samples for *Trichinella* analyses are not included. A large portion of the increased number of samples were over 3,000 red foxes (*Vulpes vulpes*) sampled for echinococcus surveillance following the first finding of the tapeworm *Echinococcus multilocularis* in Sweden, in February 2011. All dead large carnivores, lynx (*Lynx lynx*), brown bears (*Ursus arctos*), wolf (*Canis lupus*) and wolverine (*Gulo gulo*) are necropsied at SVA, or sampled when hunted or put down as problem animals. Licensed hunting of lynx, brown bear and wolf was done in 2011. In 2011, 57 Raccoon dogs (*Nyctereutes procyonoides*) killed within a project aimed at limiting the spread of this invasive species within Sweden, were necropsied, sampled and analyzed for specific infectious diseases. There was no rabies, *Echinococcus* or new parasites found. Twelve of 116 European brown or mountain hares (*Lepus europaeus* or *Lepus timidus*) were positive for tularemia. There were 544 birds or samples from birds examined, including birds of prey as many species are protected and there are routines to submit carcasses to SVA.

The diagnosed reportable wildlife diseases listed by OIE for 2011 include 102 cases (Table 18). The active disease surveillance of the tapeworm *Echinococcus multilocularis* that has been done since year 2000 noted the first finding in Sweden in 2011, in four red foxes in three counties. Trichomoniasis cases in finches increased again during 2011 after a low number reported or submitted in 2010.

## DISCUSSION

The presence of serious contagious wildlife diseases in Sweden remains at a low level, but introduction of new diseases from the European continent occur and can be expected to continue both with migrating animals and due to the high risk factor of human transportation, travel and interference.

Table 18. Wildlife diseases and number of outbreaks/cases reported to the OIE for 2011.

Disease	Wild animal species	Latin name	No. Cases 2011
Avian paramyxovirus	Rock pigeon	<i>Columba palumbus</i>	26
Echinococcosis	Red fox	<i>Vulpes vulpes</i>	3
Listeriosis	Fallow deer	<i>Dama dama</i>	1
Pox virus	Great tit	<i>Parus major</i>	1
Pseudotuberculosis	Fallow deer	<i>Dama dama</i>	1
Salmonellosis	Sparrow hawk	<i>Accipiter nisus</i>	1
Salmonellosis	Greater spotted woodpecker	<i>Dendrocopos major</i>	1
Salmonellosis	Black-headed gull	<i>Larus ridibundus</i>	1
Sarcoptic mange	Lynx	<i>Lynx lynx</i>	6
Sarcoptic mange	Red fox	<i>Vulpes vulpes</i>	8
Sarcoptic mange	Wild boar	<i>Sus scrofa</i>	6
Sarcoptic mange	Wolf	<i>Canis lupus</i>	1
Toxoplasmosis	European brown hare	<i>Lepus europaeus</i>	2
Trichinosis	Wild boar	<i>Sus scrofa</i>	3
Trichinosis	Lynx	<i>Lynx lynx</i>	11
Trichinosis	Pine marten	<i>Martes martes</i>	1
Trichinosis	Wolverine	<i>Gulo gulo</i>	2
Trichinosis	Wolf	<i>Canis lupus</i>	1
Trichomoniasis	Green finch	<i>Carduelis chloris</i>	10
Trichomoniasis	Eurasian siskin	<i>Carduelis spinus</i>	1
Trichomoniasis	Yellowhammer	<i>Emberiza citrinella</i>	1
Trichomoniasis	Wood pigeon	<i>Columba livia</i>	2
Tularemia	European brown hare	<i>Lepus europaeus</i>	6
Tularemia	Mountain hare	<i>Lepus timidus</i>	6
<b>TOTAL</b>			<b>102</b>

# Antimicrobial resistance in bacteria from animals and food

## BACKGROUND

SVA has the assignment to monitor and analyze the development of antimicrobial resistance in bacteria from animals and in bacteria from food of animal origin. This is carried out in the Swedish Veterinary Antimicrobial Resistance Monitoring Programme (SVARM) which has been running since 2000. Results of SVARM, i.e. data on antimicrobial resistance in bacteria from animals and data on sales of antimicrobials for use in animals, are published in a yearly report.

The programme is organized and run from the Department of Animal Health and Antimicrobial Strategies at SVA. Integrated with SVARM is the programme SVARMPat focusing on resistance in animal pathogens from farmed animals. SVARMPat is run in cooperation with Swedish Animal Health Service and is financed by the Board of Agriculture. The reports from SVARM are available at [www.sva.se](http://www.sva.se).

The objectives of SVARM are to detect trends in resistance and to provide a basis for recommendations on use of antimicrobials in animals. Details on methodology used are available in the report. Briefly, three types of bacteria are monitored: zoonotic bacteria, specific animal pathogens and indicator bacteria (*Escherichia coli* and *Enterococcus spp.*) from healthy animals and from food of animal origin. The rationale for monitoring indicator bacteria, i.e. commensal bacteria from the normal intestinal flora of healthy animals is that resistance among these bacteria reflects the selection pressure of use of antimicrobials in an animal population. Moreover, these bacteria can be a reservoir of mobile resistance genes that can reach humans through the food chain. By using harmonised methodology for studies on indicator bacteria, data can be compared on an international level and over time. Thereby valid conclusions on trends in resistance can be made.

## SUMMARY SVARM 2011

The 2011 report from SVARM shows that the situation regarding antimicrobial resistance in bacteria from animals remains favourable from an international perspective. However, the importance of continuous monitoring as a tool to discover appearance of new types of resistance and to identify trends is again manifested. In SVARM 2011, transferable resistance to 3rd generation cephalosporins (ESBL) in *Escherichia coli* from pigs in Sweden is reported for the first time. Also reported is the first isolation of methicillin resistant *Staphylococcus aureus* from dairy cows.

These examples illustrate a dynamic and gradually deteriorating situation. They are also examples of the complex and multifactorial background to emergence and spread of antimicrobial resistance. To guide actions to counteract resistance, it is important to fully understand the interaction of the factors involved. This is also important for assessment of the risks for animal and human health as a consequence of resistance in bacteria from animals.

However, of key importance for emergence as well as for spread of resistance is the selection pressure exerted by use of antimicrobials. The stable or declining use of antimicrobials for animals in Sweden reported in SVARM 2011 is therefore encouraging and signifies that activities to promote "prudent use" in veterinary medicine are successful. From an international perspective the level of antimicrobial use in animals in Sweden is outstandingly low.

### Use of antimicrobials

The total amount of antimicrobials used for animals was 12 593 kg in 2011. When data were expressed as mg active substance per 'population correction unit' (PCU; estimated kg live-weight of the populations of food producing animals), the sales in 2011 were

15.4 mg/PCU which is 26% lower than in 2007 and more than 50% lower than in 1992. Decreases are seen for all antimicrobial classes and for all major animal species. Sales of products for group medication are only about 10% of the total sales.

#### Zoonotic bacteria

*Salmonella* is rare in Swedish animals and most incidents involve susceptible isolates. In 2011, 72 % of the isolates were susceptible to all antimicrobials tested. Only four of 43 isolates from food producing animals and three of 28 isolates from companion animals and wildlife were multiresistant. Resistance to 3d generation cephalosporins was not observed. Only one incident involved multiresistant *S. Typhimurium* DT 104 but multiresistant monophasic *Salmonella* subspecies I, O 4,5,12:i- was found in one incident in cattle and also in a dog. There are no indications of increased occurrence of resistance, but in view of the public health consequences vigilance towards resistant *Salmonella* in food-producing animals is warranted.

In pigs, all isolates of *Campylobacter coli* were susceptible to erythromycin but a large proportion was resistant to quinolones (37%). This is in agreement with previous findings and probably caused by use of quinolones (enrofloxacin) in sows and piglets.

Methicillin resistant *Staphylococcus aureus* (MRSA) in animals is notifiable to the Board of Agriculture. In 2011, MRSA were confirmed in one cat, two horses and in four milk samples from dairy cows. Since first reported in 2006 and until the end of 2011, MRSA has been isolated from 18 dogs, 5 cats, 17 horses, 4 dairy cows and in one sample from pigs. The four isolates from cows were of *spa*-types t524 and t9111 and were the first findings of MRSA from cattle in Sweden. They were also the first isolations of MRSA with the divergent *mecA* homologue, *mecA*<sub>LG251</sub> from Swedish animals. Most isolates from

horses and the isolate from pig were of *spa*-type t011 and belonged to the livestock associated CC398. This type is common in several animal species in other countries but rare among humans in Sweden. In contrast, most isolates from dogs and cats were of *spa*-types that are common among MRSA from humans in Sweden. Since there is a zoonotic aspect to MRSA in animals, the situation should be closely monitored and measures to mitigate spread, like improved biosecurity and infection control, is of utmost importance.

#### Indicator bacteria

Resistance in indicator bacteria (*Escherichia coli* and *Enterococcus spp.*) from the intestinal flora of healthy animals, are believed to reflect the antimicrobial selective pressure in an animal population. At slaughter intestinal bacteria can contaminate carcasses and subsequently be passed along the food chain. Resistance in indicator bacteria on food can therefore be used to assess exposure of humans to resistant bacteria from food animals.

In an international perspective, resistance in indicator bacteria from pigs and pig meat was low and at similar levels as in previous years. However, resistance to ampicillin, trimethoprim or sulphonamides in *E. coli* from pigs has gradually increased since monitoring started in 2000. These three antimicrobials are commonly used in pig production and the increase is probably due to direct selection. Co-selection probably enhances selection since these three resistance traits are common in multiresistant isolates.

By screening of samples from pigs with sensitive selective cultures, *E. coli* with ESBL resistance was found in 1.6 % of the samples. This is the first finding of ESBL resistance in *E. coli* from pigs in Sweden. Notably, use of cephalosporins in pigs is insignificant in Sweden. In broilers, selective culture

confirmed previous findings of *E. coli* with ESBL or AmpC resistance in intestinal content in a large proportion of broilers. These findings cannot be explained by antimicrobial use in broiler production in Sweden and preliminary findings indicate introduction and spread from imported breeding stock.

### Animal pathogens

The overall resistance situation in pathogenic bacteria from food-producing animals in Sweden is favourable. Resistance was most common in isolates of *E. coli* from pigs and calves where resistance to ampicillin, streptomycin, tetracycline or trimethoprim-sulphonamides was not unusual. Forty percent of isolates from calves and 25% of isolates from pigs were multiresistant, which are increasing figures compared to previous years.

Resistance was rare in isolates of *Actinobacillus pleuropneumoniae* and *Pasteurella* spp. from the respiratory tract of pigs, in isolates of *Pasteurella* spp. from the respiratory tract of calves as well as in isolates of *Streptococcus equisimilis* from joints of piglets. Resistance to penicillin was not detected in these species, supporting the view that penicillin is the substance of choice for treatment of respiratory and joint infections. However, penicillin resistance was confirmed in *Mannheimia haemolytica* from calves in one herd, emphasizing the importance of monitoring.

In isolates of *Brachyspira* spp. from pigs, resistance to tiamulin occurred in *B. pilosicoli* but was not observed in *B. hyodysenteriae*. However, the majority of isolates of *B. pilosicoli* and *B. hyodysenteriae* was resistant to tylosin.

In *Aeromonas salmonicida* subsp. *achromogenes*, *Flavobacter columnare* and *Flavobacter psychrophilum* from farmed fish, deviating high MICs to florfenicol, tetracycline or nalidixic acid in some isolates indicate acquired resistance to these antimicrobials.

The resistance situation in pathogenic bacteria from companion animals is worrisome concerning *Staphylococcus pseudintermedius* from the skin of dogs. Most isolates were resistant to penicillin through beta-lactamase production and resistance to clindamycin, erythromycin, fusidic acid or tetracycline was also common. Multiresistance occurred in 36% of the isolates and 7% were resistant to five or more antimicrobials. In Sweden isolates of methicillin resistant *S. pseudintermedius* (MRSP) are notifiable. During 2011, 53 cases were reported to the Board of Agriculture. Since first detected in 2008, ESBL resistance has been confirmed in 19 isolates of *Enterobacteriaceae*. Isolates of *Pseudomonas aeruginosa* from the external ear of dogs were susceptible to polymyxin B, but resistance to gentamicin and enrofloxacin occurred.

Resistance in pathogenic bacteria from horses is mostly in level with previous years. However, ESBL resistance has been confirmed in 33 isolates of *Enterobacteriaceae* since 2008, and the situation must be closely monitored. In isolates of *E. coli*, resistance to streptomycin and trimethoprim-sulphonamides was most common. Resistance to penicillin through beta-lactamase production in isolates of *Staphylococcus aureus* from skin samples occurred in 20% of the isolates. Isolates of *Streptococcus zooepidemicus* from the respiratory tract were uniformly susceptible to penicillin, but resistance to trimethoprim-sulphonamides occurred.





**visiting address.** Ulls väg 2B **address.** 751 89 Uppsala **telephone.** +46 18-67 40 00  
**fax.** +46 18-30 91 62 **e-mail.** sva@sva.se **webb.** www.sva.se