



BENV

National Veterinary Epidemiological Bulletin



IZSAM G. CAPORALE
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INDEX

-	EDITORIAL	3
-	IN THESE MONTHS	
	Electronic prescription for veterinary drugs	4
-	HAND ON DATA	
	Number of outbreaks reported by regions to SIMAN in the 1 st semester 2017	8
	Number of outbreaks reported by Regions to SIMAN in the 1 st semester 2017	9
	Animals involved in outbreaks reported to SIMAN in the 1 st semester 2017	11
-	A LOOK AT THE MAPS	13
-	AROUND US	
	African swine fever (ASF) in the European context	16
	Epidemiological situation of Foot and mouth disease (FMD) in North Africa	23
-	OFFICIALLY FREE TERRITORIES	30
-	CONTACTS & EDITORIAL STAFF	34



EDITORIAL

The BENV as a tool for disseminating information

Dear readers,

We hope this new issue of the BENV will enjoy you in this hot summer with new interesting articles.

In the section **In these months**, you can find an interesting article on the **Electronic prescription for veterinary drugs**. The Italian Ministry of Health has released the information system for the digitalised veterinary drugs chain and its traceability: the testing phase for the use of electronic prescription started at the end of 2015. “*The Computerization in this area*,” explained Minister Lorenzin, “*represents the flagship of our country and is part of the broader project for the implementation of applications of the Ministry of Health, always at the forefront of adopting new technologies in veterinary medicine. The goal is to reduce and simplify daily operations through the use of tablets and smartphones*”. Thanks to the new system for computerization of prescriptions, veterinarians have just to enter the data of the drug using tablet, smartphone or a traditional computer. In addition to speeding up procedures, the connection with the Central Drugs database will ensure the traceability of veterinary drugs. Cross-checking data of sales and prescriptions will make possible not only improving the effectiveness of drugs-surveillance actions, but also having a much more precise picture of antibiotic consumption, an essential tool for contrasting the antimicrobial-resistance phenomenon.

In the section **Around us**, another article shows the different scenarios of **African swine fever (ASF) in the European context**. ASF is still a concrete threat to the European pig sector: the presence of endemic infection in several European countries requests high level of attention to adequately address the risk of viral introduction into free territories. In Eastern Europe, the spread of the disease is essentially attributable to domestic pigs: the low level of biosecurity in farms is responsible for “local” transmission, while food trade has been the likely cause of long distance transmission of infection. In Northern Europe, however, the main epidemiological role is supported by wild boar, while the involvement of domestic pigs is more limited: the persistence of infection is expedited by the contamination of wooded areas where the carcasses of wild boars may remain infected for many months, also due to climatic conditions that favour their preservation. In Sardinia, ASF has been endemic for nearly forty years, despite the applied control measures: the persistence of infection is favoured by free ranging pigs in the centre-east region of the island, historically endemic, this type of husbandry represents an epidemiological link of fundamental importance between the domestic population and the population of wild boars.

In the same section, another article is focused on the **epidemiological situation of Foot and mouth disease (FMD) in North Africa**. The recrudescence of FMD serotype A virus in Algeria is raising constant concern among North African Health Authorities and encourage them to increase the level of responsiveness: in absence of any surveillance system and of vaccination campaigns, the disease could become endemic in North Africa due to the virus incursions from the Middle East and Sub-Saharan regions. Moreover, the risk of introducing FMD into Europe from North Africa is not negligible and can be amplified if FMD becomes endemic in North African region. In this context, it should not be neglected the negative effects of the political instability in some countries adjoining the Mediterranean basin since the veterinary public health challenges cannot be isolated from matters related to political insecurity.

The **Hand on data** section shows data on outbreaks of animal diseases, the health status of the Italian regions and the animal species involved in the outbreaks reported to SIMAN in the first semester 2017. Moreover, the tables and maps of the **Officially free territories** have been updated: according to Commission implementing Decision 2017/888/EU Umbria region has acquired the officially free status from bovine tuberculosis.

The distribution of the main animal diseases occurred in Italy in the first semester 2017 is shown in the section **A look to the maps**.

We have the pleasure to publish your articles: in the space **Submit your article** you can find the guidelines for authors and submit the article to the editorial staff.

Waiting for comments or suggestion you feel useful for improving the Benv, that you can send us by filling in the form in the space **Suggestions**, we wish you a happy summer and give the appointment for the **next issue**.

Simona Iannetti
COVEPI



IN THESE MONTHS

The main events of epidemiological interest in the last months in Italy and in the European Union

The Electronic prescription for veterinary drugs

Introduction

The “digital revolution”, constantly powered by the diffusion of mobile peripherals and the widespread digitization, is changing everything in many areas radically. This rampant innovation has brought with it new organizational and operational models, and has made necessary to change the relationship between individuals and public administrations through bureaucratic simplification and dematerialization.

The project

The Electronic prescription for veterinary drugs is a project of the MINSAL [Italian Ministry of Health (Direction General for animal health and veterinary drugs)] aimed at the full digitization of the management of veterinary drugs, from prescription to the treatment of the animals. The introduction of the Electronic veterinary prescription is therefore a tool and not the ultimate goal of the project, which includes digitization and traceability of sales, stockholding and use of veterinary drugs (Figure 1).



Figure 1. Data flow for the management of veterinary drug: from the left to the right

Purposes

The Electronic prescription for veterinary drugs is contextualized in the MINSAL policies for “public health, animal welfare and food safety”. The project therefore has health purposes, to make the use of the veterinary drug in Italy more “measurable” by digitizing and dematerializing the information now printed on paper. This project is also included in the implementation by the MINSAL of a traceability system throughout the veterinary drug supply chain. The main objectives pursued by the project are the following:

- Digitizing all the information currently handled in paperwork and collected for the traceability of the veterinary medicinal product;
- Simplifying the operation of citizens in meeting regulatory obligations by introducing new organizational and operational models through “intensive digital use” interaction.

The Electronic prescription for veterinary drugs does not introduce any new obligations or rules in relation to current legislation, but is intended to simplify and, wherever possible, reduce the obligations of citizens by recovering information already available in ministerial information systems.

The innovation

Although the project introduces full digitization (“we’ve gone from four paper copies to zero”¹), the full involvement and collaboration of all actors involved in drug management have been the true innovation in the testing phase of the system. The testing has enabled to “fine-tune” and validate the computerized management of the veterinary drug in livestock sector with the participation of the National Health Service Centre of the MINSAL (IZSAM G. Caporale) and of all the players in the chain:

- veterinary practitioners;
- holders and owners of animals;
- wholesalers and pharmacists;
- Veterinary services of Local Health Units and of the Regions.

The Electronic prescription for veterinary drugs: how it works

The veterinarian can issue an electronic prescription using any computer connected to the Internet, or by using a mobile device (tablet or smartphone) that can operate in off-line mode through an application that simplifies and where possible automates data entry (animals from the farm register, authorized species and time of suspension of the drug, etc.).

- The prescriptions are no longer separate according to the type of medicine (triple copy, repeatable or non-repeatable prescription, medicated feed), but only according to the purpose. The electronic prescription for veterinary drugs will be immediately available online and usable, for the sale of drugs, by pharmacies and wholesalers through its own number and PIN. It is possible to retrieve the
- prescription through the holding code or the farmer’s tax ID (Figure 2).

¹ Mario Facchi, veterinarian, involved from 2015 in testing in Lombardy and Advisor for the Italian livestock veterinary Society (SIVAR).

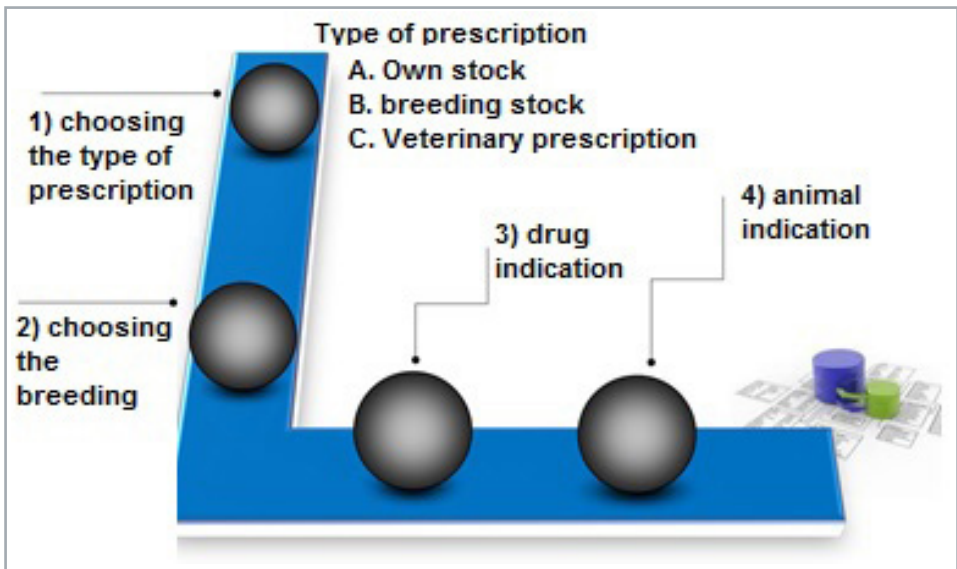


Figure 2. Electronic prescription release

In addition to the complete “dematerialization” of the prescription, the electronic management of the register of loading and unloading of stocks of veterinary drugs is foreseen and, as an alternative to paper handling, of the treatment register.

The complete “dematerialization” of the prescription eliminates the paperwork management of the loading-unloading register of veterinary drugs (of veterinarian and of the breeding). The register will also be automatically updated at the moment of the pharmacist’s delivery to the farmer of the drugs.

It is possible to manage the administration of veterinary drugs (treatment) through the following operating modes:

- Register of treatments handled in paper mode (mixed management);
- Register of treatments handled in computerized mode (full management).

In both modes, the loading -unloading register of the drugs will be electronic. In case a computerized management of the register of treatment is used, the information will be used for the automatic compilation of the dedicated section of the dematerialized model 4.

The Electronic prescription in Numbers

The first results of the testing phase are shown in the figures 3 and 4 below (data updated to the half of July 2017).

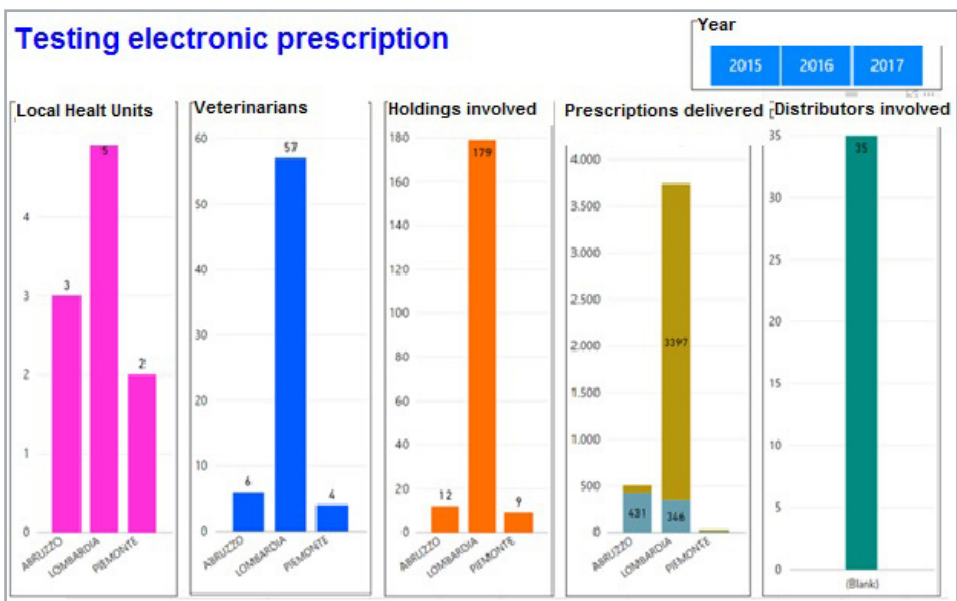
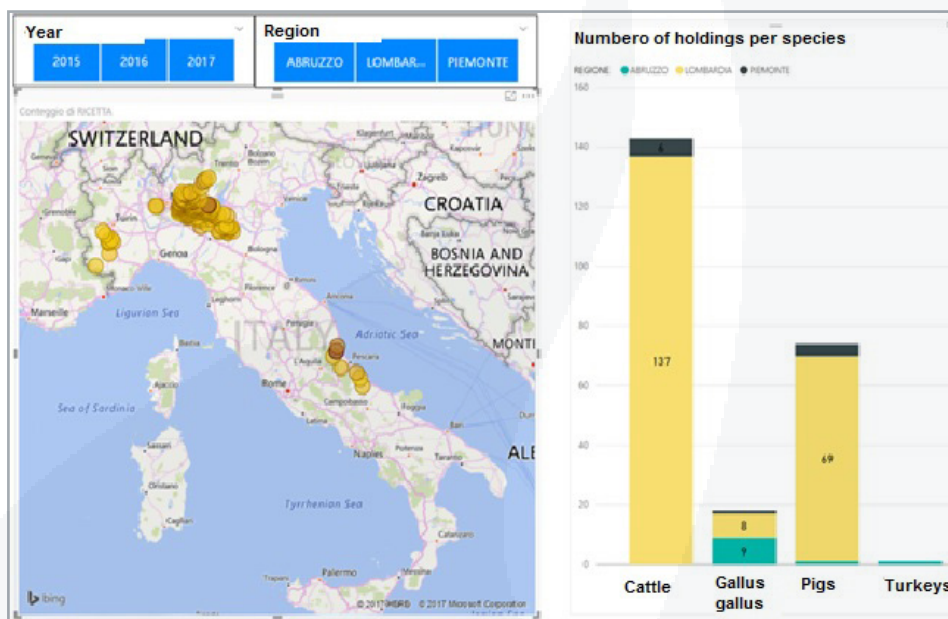


Figure 3. Preliminary data on testing phase

Figure 4. Holdings involved in the testing phase



Conclusions

Following public health safety objectives already covered by Directive 2001/82/EC, Italy is preparing for computerization of recording the production, marketing and distribution data of veterinary drugs and replacing the paper prescription with a computerized form. The computerization of the traceability of veterinary drugs is expressly foreseen in the 2015-2017 Agenda for Simplification, which contains a targeted action on veterinary health, to be implemented by December 2017; in addition to eliminating the requirement for cattle passport, the Agenda provides for digitization and traceability of veterinary drugs.

The testing of the electronic prescription has been the result of a joint work of the Ministry of Health and the IZS of Abruzzo and Molise with Lombardy and Abruzzo Regions (and from 2017 Piedmont), veterinary practitioners, associations, wholesalers and pharmacists, feed plants, food production chains, breeders and Local Health Units of the involved Regions. It has been a long journey that led the Electronic prescription from “testing” to the [2017 European Law](#), which introduced the Electronic prescription for veterinary drugs and medicated feeding stuffs from 1 September 2018.

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HAND ON DATA

Processing date: 7^h July 2017

Number of outbreaks reported to SIMAN in the first semester 2017

Number of outbreaks reported to SIMAN in the first semester 2017							
Disease	January	February	March	April	May	June	Total outbreaks
Aethina tumida			3	1			4
African swine fever	28	1	6	1	4	2	42
American foulbrood of honey bees		1	4	2	2	8	17
Avian cholera						1	1
Bluetongue	41	13	20	14	10	4	102
Bovine leucosis	1	1	1	3		1	7
Bovine tuberculosis	19	21	34	28	37	26	165
Brucellosis of cattle, buffalo, sheep, goats and pigs	31	41	72	41	70	39	294
Caprine arthritis/encephalitis					1		1
Chlamydomphila abortus infection (Enzootic abortion of ewes, ovine chlamydiosis)						1	1
Contagious agalactia	5	3	8	3	8	5	32
Contagious bovine mastitis					1		1
Equine infectious anaemia	6	3	6	4	1	2	22
Erysipelas	3	2	3	1			9
European foulbrood of honey bees				2	3	1	6
High pathogenicity Avian influenza in poultry	3	6	4	2	1		16
High pathogenicity Avian influenza in wild birds	3			1	1		5
Leptospirosis	2	3	4			1	10
Mange of equidae, bovines, buffaloes, ovine and caprine			1				1
Mixomatosis				1			1
Non-typhoidal avian salmonellosis	1	1	3	3	4		12
Nosemiasis	1						1
Paratuberculosis					1		1
Pasteurellosis of cattle, buffalo, sheep, goats and pigs				1			1
Q fever	1						1
Rabbit haemorrhagic disease	1		3	3	1	2	10
Salmonellosis (S. abortusovis)	7	5	1			1	14
Salmonellosis of animals	1		1				2
Scrapie	4	7	6	6	1	4	28
West Nile Disease	1						1

Number of outbreaks reported by Regions to SIMAN in the first semester 2017

Number of outbreaks reported by Regions to SIMAN in the first semester 2017								
Region	Disease	January	February	March	April	May	June	Total outbreaks
ABRUZZO	Bluetongue	1					2	3
	Brucellosis of cattle, buffalo, sheep, goats and pigs		1	3	1			5
	Equine infectious anaemia		1	3	1	1	1	7
	Non-typhoidal avian salmonellosis					1		1
APULIA	Bluetongue	1	1			1		3
	Bovine leucosis	1	1		2		1	5
	Bovine tuberculosis	4	2	1	2	9	1	19
	Brucellosis of cattle, buffalo, sheep, goats and pigs	1	2	9	3	9	2	26
	Equine infectious anaemia				1			1
	Scrapie				2	1		3
BASILICATA	Avian cholera						1	1
	Bluetongue	1	1	1	1	1		5
	Bovine tuberculosis	1				3	1	5
	Brucellosis of cattle, buffalo, sheep, goats and pigs		2	7	1	2	1	13
BOLZANO	Scrapie			1				1
	American foulbrood of honey bees			1				1
CALABRIA	Aethina tumida			3	1			4
	Bluetongue	2	2	3				7
	Bovine tuberculosis	2		4		3		9
	Brucellosis of cattle, buffalo, sheep, goats and pigs	3	12	14	7	13	10	59
	Scrapie			1				1
CAMPANIA	Bluetongue		3	1	1	1		6
	Bovine leucosis			1				1
	Bovine tuberculosis	3	6	3	6	4		22
	Brucellosis of cattle, buffalo, sheep, goats and pigs	4	7	5	3	8	4	31
	Equine infectious anaemia		1	1				2
	Non-typhoidal avian salmonellosis	1						1
	Rabbit haemorrhagic disease				1			1
	Salmonellosis of animals			1				1
	Scrapie	3						3
EMILIA ROMAGNA	American foulbrood of honey bees		1	3		1	6	11
	Bluetongue	1	1	1				3
	Brucellosis of cattle, buffalo, sheep, goats and pigs			1		1	1	3
	Contagious bovine mastitis					1		1
	Equine infectious anaemia			1			1	2
	Erysipelas			2	1			3
	European foulbrood of honey bees				1			1
	High patogenicity Avian influenza in poultry		1		1			2
	Non-typhoidal avian salmonellosis				1			1
	Nosemiasis	1						1
	Scrapie				1			1
	West Nile Disease	1						1
	FRIULI VENEZIA GIULIA	Bluetongue	2	1	3	4	1	1
High patogenicity Avian influenza in poultry				1				1
High patogenicity Avian influenza in wild birds		3						3
Leptospirosis				2				2
LAZIO	American foulbrood of honey bees				2			2
	Bluetongue				2			2
	Bovine leucosis				1			1
	Bovine tuberculosis	1	1	1			1	4
	Chlamydia abortus infection (Enzootic abortion of ewes, ovine chlamydiosis)						1	1
	Equine infectious anaemia	4			2			6
	European foulbrood of honey bees				1			1
	Leptospirosis	1		1				2
	Salmonellosis (S. abortusovis)		1					1
	Salmonellosis of animals	1						1
	Scrapie	1	1					2
LOMBARDY	Bluetongue	1						1
	High patogenicity Avian influenza in poultry		2			1		3
	High patogenicity Avian influenza in wild birds					1		1
	Leptospirosis		1				1	2
	Non-typhoidal avian salmonellosis		1	1	1	2		5
	Rabbit haemorrhagic disease						1	1
	Scrapie		1					1
MARCHE	Bovine tuberculosis				1			1
	Equine infectious anaemia		1					1
	Erysipelas		1	1				2
	Non-typhoidal avian salmonellosis			1				1
	Scrapie			2				2
MOLISE	Bluetongue				1	1		2
	Brucellosis of cattle, buffalo, sheep, goats and pigs			1				1
	Equine infectious anaemia			1				1
	Non-typhoidal avian salmonellosis					1		1

Number of outbreaks reported by Regions to SIMAN in the first semester 2017									
Region	Disease	January	February	March	April	May	June	Total outbreaks	
ABRUZZO	Bluetongue	1					2	3	
	Brucellosis of cattle, buffalo, sheep, goats and pigs		1	3	1			5	
	Equine infectious anaemia		1	3	1	1	1	7	
	Non-typhoidal avian salmonellosis					1		1	
APULIA	Bluetongue	1	1			1		3	
	Bovine leucosis	1	1		2		1	5	
	Bovine tuberculosis	4	2	1	2	9	1	19	
	Brucellosis of cattle, buffalo, sheep, goats and pigs	1	2	9	3	9	2	26	
	Equine infectious anaemia				1			1	
	Scrapie				2	1		3	
BASILICATA	Avian cholera						1	1	
	Bluetongue	1	1	1	1	1		5	
	Bovine tuberculosis	1				3	1	5	
	Brucellosis of cattle, buffalo, sheep, goats and pigs		2	7	1	2	1	13	
BOLZANO	Scrapie			1				1	
	American foulbrood of honey bees			1				1	
CALABRIA	Aethina tumida			3	1			4	
	Bluetongue	2	2	3				7	
	Bovine tuberculosis	2		4		3		9	
	Brucellosis of cattle, buffalo, sheep, goats and pigs	3	12	14	7	13	10	59	
	Scrapie			1				1	
CAMPANIA	Bluetongue		3	1	1	1		6	
	Bovine leucosis			1				1	
	Bovine tuberculosis	3	6	3	6	4		22	
	Brucellosis of cattle, buffalo, sheep, goats and pigs	4	7	5	3	8	4	31	
	Equine infectious anaemia		1	1				2	
	Non-typhoidal avian salmonellosis	1						1	
	Rabbit haemorrhagic disease				1			1	
	Salmonellosis of animals			1				1	
	Scrapie	3						3	
EMILIA ROMAGNA	American foulbrood of honey bees		1	3		1	6	11	
	Bluetongue	1	1	1				3	
	Brucellosis of cattle, buffalo, sheep, goats and pigs			1		1	1	3	
	Contagious bovine mastitis					1		1	
	Equine infectious anaemia			1			1	2	
	Erysipelas			2	1			3	
	European foulbrood of honey bees				1			1	
	High pathogenicity Avian influenza in poultry		1		1			2	
	Non-typhoidal avian salmonellosis				1			1	
	Nosemiasis	1							1
	Scrapie				1			1	
	West Nile Disease	1							1
FRIULI VENEZIA GIULIA	Bluetongue	2	1	3	4	1	1	12	
	High pathogenicity Avian influenza in poultry			1				1	
	High pathogenicity Avian influenza in wild birds	3						3	
	Leptospirosis			2				2	
LAZIO	American foulbrood of honey bees				2			2	
	Bluetongue				2			2	
	Bovine leucosis				1			1	
	Bovine tuberculosis	1	1	1			1	4	
	Chlamydia abortus infection (Enzootic abortion of ewes, ovine chlamydiosis)						1	1	
	Equine infectious anaemia	4			2			6	
	European foulbrood of honey bees				1			1	
	Leptospirosis	1		1				2	
	Salmonellosis (S. abortusovis)		1					1	
	Salmonellosis of animals	1						1	
Scrapie	1	1					2		
LOMBARDY	Bluetongue	1						1	
	High pathogenicity Avian influenza in poultry		2			1		3	
	High pathogenicity Avian influenza in wild birds					1		1	
	Leptospirosis		1				1	2	
	Non-typhoidal avian salmonellosis		1	1	1	2		5	
	Rabbit haemorrhagic disease						1	1	
	Scrapie		1					1	
MARCHE	Bovine tuberculosis				1			1	
	Equine infectious anaemia		1					1	
	Erysipelas		1	1				2	
	Non-typhoidal avian salmonellosis			1				1	
	Paratuberculosis					1		1	
Scrapie			2				2		
MOLISE	Bluetongue				1	1		2	
	Brucellosis of cattle, buffalo, sheep, goats and pigs			1				1	
	Equine infectious anaemia			1				1	
	Non-typhoidal avian salmonellosis					1		1	

Animals involved in outbreaks reported to SIMAN in the first semester 2017

Animals involved in outbreaks reported to SIMAN in the first semester 2017

Disease	Animals involved	No. Of animal in the holding	No. Of diseased animals	No. Of died animals	No. Of culled animals	No. Of destroyed animals
Aethina tumida	Bees	205	35	1	204	205
African swine fever	Suidae	359	237	71	284	354
American foulbrood of honey bees	Bees	442	60	0	57	57
Avian cholera	Poultry	222	2	2	0	2
Bluetongue	Acquatic animals	4	1	0	0	0
	Ruminants	12709	267	5	1	3
Bovine leucosis	Ruminants	423	9	0	1	1
Bovine tuberculosis	Ruminants	12316	776	3	63	22
Brucellosis of cattle, buffalo, sheep, goats and pigs	Ruminants	31039	3011	18	695	506
	Suidae	29	12	0	0	0
Caprine arthritis/encephalitis	Ruminants	236	23	0	0	0
Chlamydomphila abortus infection (Enzootic abortion of ewes, ovine chlamydiosis)	Ruminants	570	2	2	0	2
Contagious agalactia	Ruminants	11557	1542	3	0	3
Contagious bovine mastitis	Ruminants	41	2	0	0	0
Equine infectious anaemia	Equines	213	37	0	1	0
Erysipelas	Suidae	8582	39	21	2	23
European foulbrood of honey bees	Bees	131	6	0	1	1
High pathogenicity Avian influenza in poultry	Poultry	357585	119629	4638	352047	356609
High pathogenicity Avian influenza in wild birds	Birds	10003	5	5	0	4
	Domestic carnivores	6	3	2	0	1
Leptospirosis	Equines	155	34	0	0	0
	Ruminants	384	24	0	0	0
	Suidae	3001	26	0	0	0
Mange of equidae, bovines, buffaloes, ovine and caprine	Ruminants	108	100	0	0	0
Mixomatosis	Lagomorphs	1	1	1	0	1
Non-typhoidal avian salmonellosis	Poultry	186580	129344	0	8425	8425
Nosemiasis	Bees	17	17	16	0	16
Paratuberculosis	Ruminants	157	1	0	0	0
Pasteurellosis of cattle, buffalo, sheep, goats and pigs	Ruminants	180	10	8	0	8
Q fever	Ruminants	264	6	0	0	0
Rabbit haemorrhagic disease	Lagomorphs	3825	835	834	801	1633
Salmonellosis (S. abortusovis)	Ruminants	7929	184	0	0	0
Salmonellosis of animals	Poultry	11050	3200	0	0	0
	Suidae	51	1	0	0	0
Scrapie	Ruminants	13235	35	11	2	12
West Nile Disease	Birds	1	1	1	0	1





A LOOK AT THE MAPS

The geographical distribution of the main animal diseases reported to SIMAN in the 2nd semester 2017

Processing date: 12th July 2017

Aethina tumida



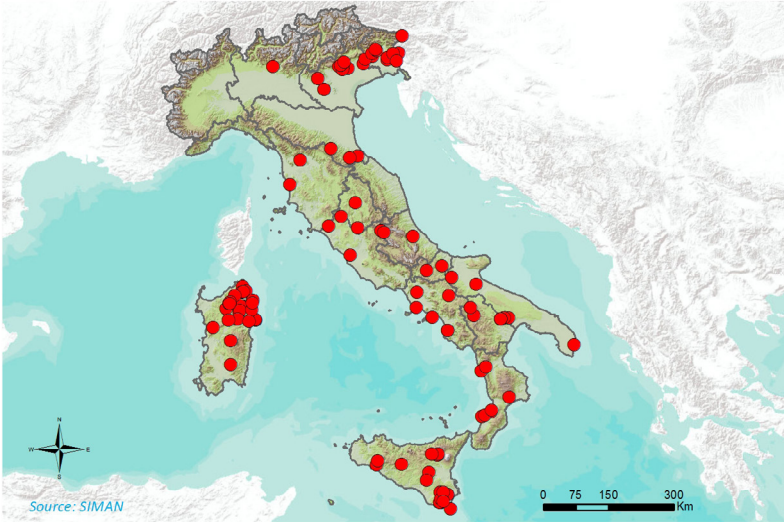
Geographical distribution of the outbreaks

Equine Infectious Anaemia



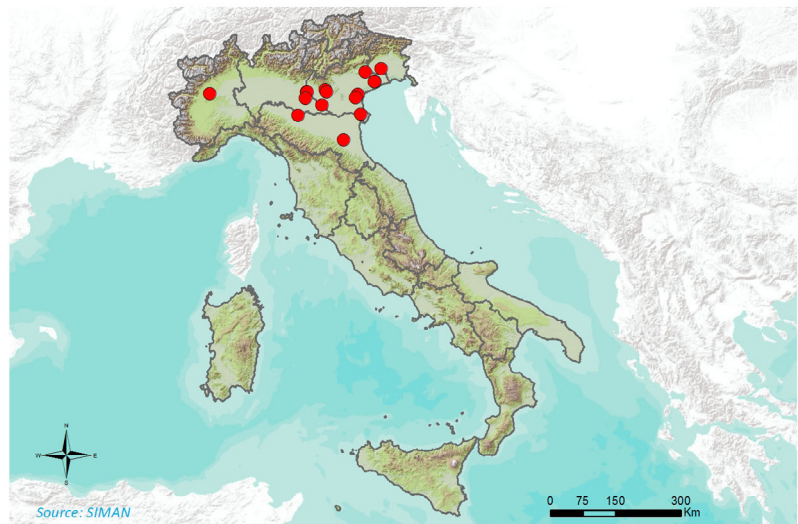
Geographical distribution of the outbreaks

Bluetongue



Geographical distribution of the outbreaks

Avian influenza high patogenicity



Geographical distribution of the outbreaks

African swine fever



Geographical distribution of the outbreaks

West Nile Disease



Geographical distribution of the outbreaks



AROUND US

The main events of epidemiological interest in the last months in the European Union and in the neighbour countries

African Swine Fever: different scenarios in the European context

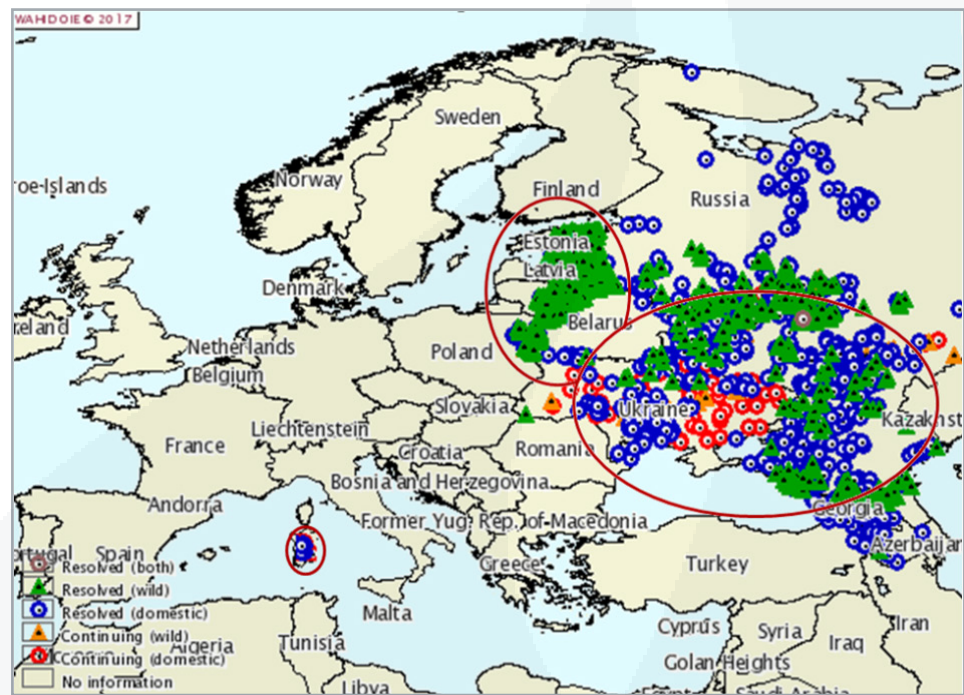
Background

African Swine Fever (ASF) is an infectious disease of domestic and wild pigs, caused by a virus that remains the only representative of the genus in the Asfivirus Asfarviridae family; along with Classic Swine Fever (CSF), from which it is clinically indistinguishable, it represents one of the most feared diseases in the pig sector, because mortality and morbidity rate of these infection can reach 100% of susceptible populations (Gallardo et al. 2015). The ASF virus is the only arbovirus with a DNA genome: it can, in fact, be transmitted, but above all, it can replicate in some species of arthropods (soft ticks of the genus *Ornithodoros*) which therefore could play an important role as factors for infections persisting in the environment factor (T.G. Burrage 2013).

The disease was discovered in Africa in 1921; later, ASF was reported in Europe (Portugal 1957, 60-94, Spain 1960-95, France 1964, Italy 1967, 69, 78, Russia 1977, Malta 1978, Belgium 1985, Holland 1986) and also in America (Cuba 1971, 1980, Brazil 1978, Dominican Republic 1978, Haiti 1979). In many African states, in addition to domestic swine, wild pigs (*Phacochoerus africanus*, *Hylochoerus meinertzhageni*, and *Potamochoerus larvatus*) are the reservoirs for infections by ticks (*O. moubata*). Elsewhere, the disease affects both domestic pigs and boars; in Europe the role of ticks (*O. erraticus*) is recognized as minor because these organic carriers are not present in a uniform way across the continent (Costard S. et al. 2013).

Until the end of the 1990s, ASF was dangerously underestimated: at that time, the infection had been eradicated by several territories (e.g. Latin America, Western Europe) and the Sardinian Region was the only endemic area beyond the African continent. In 2007, the infection was reported in the Caucasus, immediately causing the alarm of experts at an international level: in this area, the disease has found ideal conditions to spread not only in the dense network of family farms characterised by low levels of biosecurity, but also in the wild boar population; the infection rapidly expanded northwards, gradually affecting the Russian Federation and several other republics of the former Soviet Union and also involving EU member states (OIE 2017). Currently, in Europe, the threat posed by ASF is based on at least three different scenarios that will be described below.

Figure 1.
ASF outbreaks in Europe 2007-2016
(modified OIE map): in evidence
three distinct epidemiological
scenarios



Scenario I: Eastern Europe

As mentioned above, ASF arrived in the Caucasus region in 2007. The infection immediately affected the domestic pig farming system, which consists of a network of family-run farms characterised by a low level of biosecurity. The system is based on labour-sharing and exchanges of equipment and/or animals, moreover does not even include any effective separations from the wild environment; scarce resources of competent authorities made impossible to front the epidemic emergency appropriately, and the infection rapidly spread to the north (A. Gogin 2013). ASF infection did not however spread from the Caucasus to the south: over the southern border of Georgia and Armenia lies Turkey where, for religious reasons, pig farming is virtually absent; this lack of spread confirmed the importance of the role played by domestic pigs, which were obviously insufficient to spread the infection by themselves. The movement of goods and people has also contributed to spreading the infection at a surprising speed, even hundreds of kilometres from the initial epicentre of the outbreaks, progressively involving neighbouring states and in particular, the Russian Federation, Belarus and Ukraine (OIE 2017).

Certainly, in this scenario, the main epidemiological role is therefore attributable to domestic pigs: the low levels of biosecurity on farms is basically responsible for “local” type transmission, while the transfer of pork products is the most likely cause of the infections that move over long distances (Vergne et al. 2015). The role of wild pigs, albeit secondary, should not be underestimated however, especially to explicate the persistence of ASF infection in those areas where the disease has become as endemic and appears beyond the control of the competent veterinary authorities (Iglesias et al. 2015).

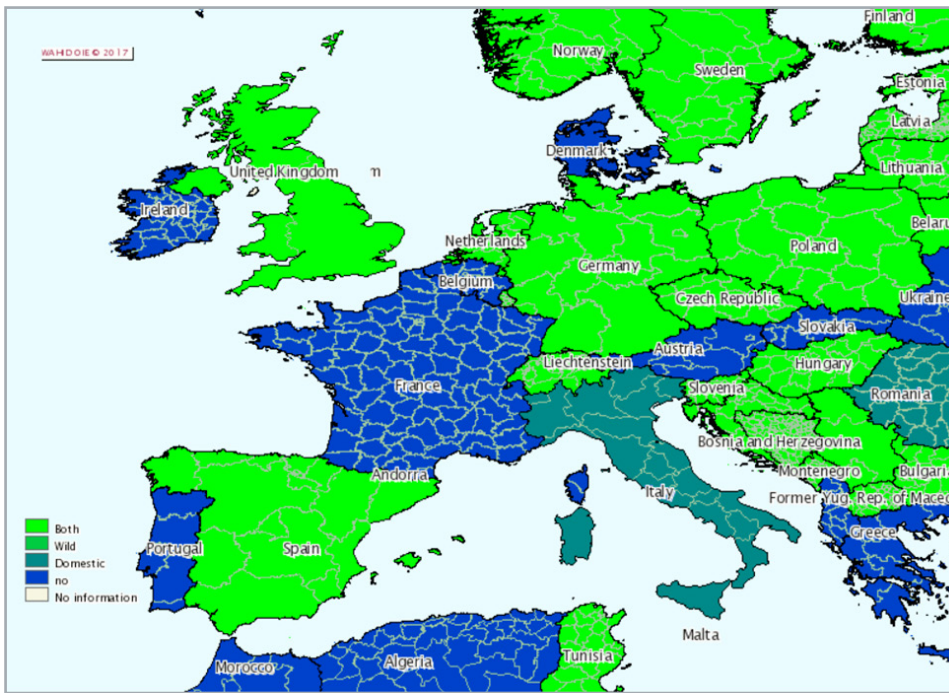


Figure 2. Map of European countries that implemented measures to control the ASF among domestic and/or wild pig population (OIE data)

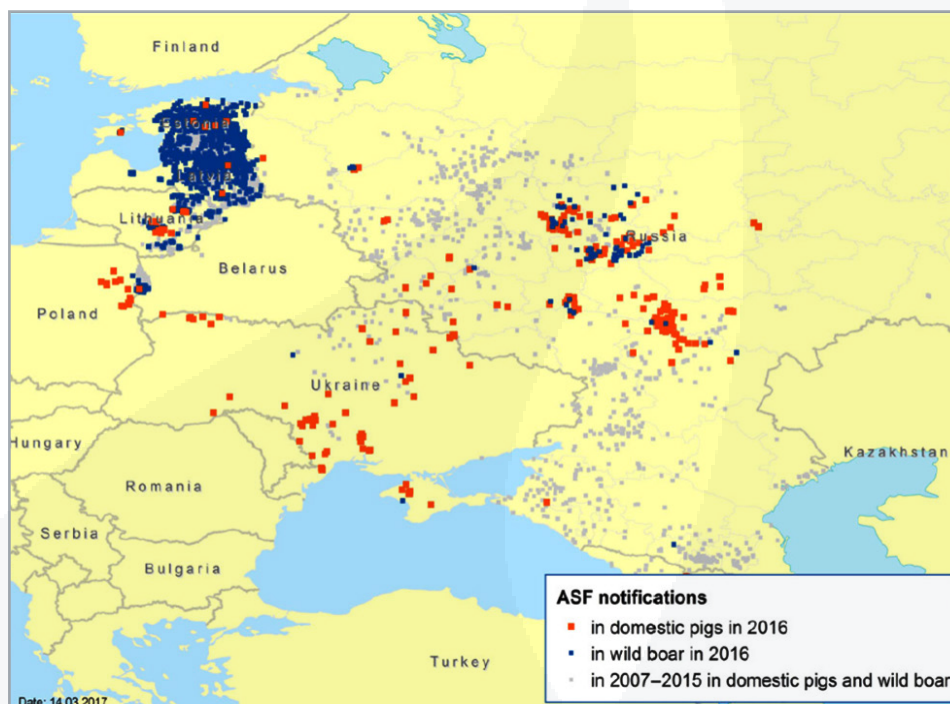
Scenario: Northern Europe (EU member states)

The pressure caused by outbreaks in domestic and wild populations in the former Soviet republics has ended up involving several European Union member countries. The first notifications were reported in Poland, and subsequently, the Baltic States (Estonia, Lithuania and Latvia) have become progressively involved; it should be remembered that, in this area, the infection developed and took root in the territories near the border with Belarus and Ukraine (OIE 2017).

Unlike the scenario described above, in the European Union states that were affected by ASF infections, the main epidemiological role is supported by wild pigs as well as the involvement of domestic pig holdings appears more limited. Evidently, disease control implemented by the veterinary services has been more effective despite, even in these countries, there is a significant presence of backyard farms, characterised by a low biosecurity level. The main risk factors facilitating the infection persistence are related to the contamination of wooded areas, where the carcasses of infected animals could contribute to the spread of the disease for many months because the climatic conditions favour their preservation.

A recent EFSA study (EFSA 2017) examined the evolution of the epidemiological dynamics present in this scenario, and noted that the speed of infection spread in the wild pig population is relatively low. The study was based on mathematical models and estimated an infection movement speed of about 1-2 km per year. Clearly, these estimates should be considered by taking the delicate environmental balance into account: the experts inform us that wild boars are basically sedentary creatures that maintain a restricted home range under conditions where they have adequate food available and, particularly, where there are no external factors to disturb them, like indiscriminate hunting practices (Thurfjll et al. 2013).

Figure 3.
ASF notified outbreaks in domestic
and wild pig population in East
Europe (EFSA data)



Scenario: Sardinian Regions

ASF has been endemic in Sardinia since 1978: despite control measures being applied with increasing intensity, and having been even more accentuated over recent years, the goal of eradication is still not immediately achievable. Several risk factors remain, which ensure the infection persists at least in the historically endemic area, located in the central eastern part of the island; in this area, which is characterised by an impervious and sometimes wild territory, the centuries-old practice of farming feral pigs on public pastures remains, and represents a key epidemiological link between the domestic pig populations and the wild boars (Mur et al. 2016). The overlap of these particular epidemiological conditions, together with other social and economic factors is the main obstacle to actions promoted by the National and Regional Government, which have, with unprecedented commitment, put significant economic resources and new strategies for combating infection in place. In particular, it has intensified the fight against illegal farms via the use of forced culling; moreover, the Sardinian authorities have promoted more up to date animal husbandry models: economic incentives have been made available to farmers to improve the levels of farms biosecurity and to promote the exclusive marketing of high quality local pig products, made in accordance with local traditions (Sardinia Region 2014).

In this context, some successes have been recorded, like the narrowing of infected domestic areas: over recent years there had been clusters of infections in the provinces of Sassari and Olbia-Tempio, whilst at present, the outbreaks are limited to the provinces of Nuoro and Ogliastra; on the other hand, some worrying aspects remain, such as the notification of a few sporadic outbreaks in the province of Cagliari. The persistence of the infection in the wild pig population should never be forgotten: the incidence of cases has not diminished, and wild boars are now considered as a reservoir for the infection. The relevance of wild boar role in this contest is only secondary to the presence of illegal feral pigs; both these overlapping population can therefore be considered as crucial to maintain the high viral pressure in the area. Just to re-dimension this factor, the Sardinian Region has promoted a plan to regulate hunting, which aims to raise the level of biosecurity of hunting activities, monitor the epidemiological situation and contain the increase in wild boar population density (Sardinia Region 2015).

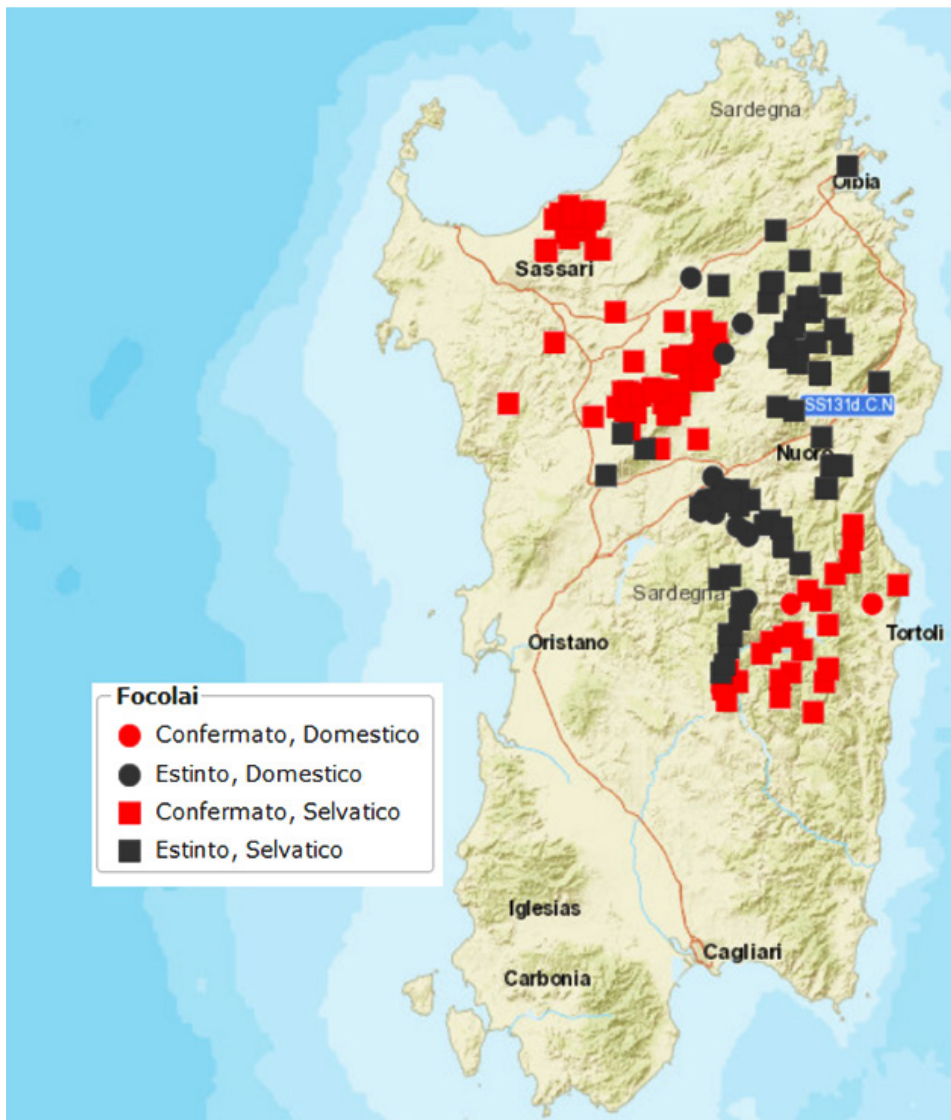


Figure 4. ASF outbreaks notified in Sardinia region during the 2016 (SIMAN data)

Discussion

ASF remains a real threat for the European pig sector: the presence of infection in an endemic form in several countries on the continent compels the maintenance of a high level of vigilance to protect this important sector of the economy.

The viral circulation in feral pig populations on the eastern border of the European Union may represent the tip of the iceberg for a much larger phenomenon, in view of the ways ASF infections are spread. It has now been shown that in wild populations, the infection tends to spread at very low speeds (EFSA 2017) if the natural dynamics of the species are maintained unaltered; much more worrying, human interventions are thought capable of causing significant movements of the fauna, particularly through indiscriminate hunting activities. The environmental conditions that, particularly at higher latitudes, favour maintenance of the environment viral pressure, however demand continuous surveillance of the epidemiological situation; it is also important to create conditions for effectively separating domestic and wild population by raising the levels of biosecurity on farms: this measure is important for both factory farming and on domestic farms.

Human behaviour thus remains the most important risk factor for the spread of ASF infections, both locally and long-range. It is worth remembering that one of the main transmission routes for the infection is the movement of contaminated foodstuffs, whose wastes can be used to feed pigs bred in subsistence conditions; if we take this evidence into account, it is clear that the risk of further spread of the infection to the west from countries where it is already endemic to those still free, is far from negligible (JM Vizcaino 2012).

From this perspective, the situation in Sardinia seems less worrying: if the reservoir of infection in historically endemic areas appears not to be immediately extinguishable, it is considerable that the ban of pork products export was effective in containing the infection to the island. In any case, after the efforts applied in the recent past, it is time to redouble energies and resources to achieve eradication of the infection by eliminating the persistent infection sources in internal island areas: this will be possible by pursuing the strategy of promoting new animal husbandry models combining traditional values with modern farming techniques and the promotion of local produces. The current contraction of ASF infections is due to biosecurity measures being applied, like the construction of protective barriers at farms in free areas; to complete the preventive actions, every country should set up emergency plans to front the occurrence of first outbreaks of the infection effectively. Experience has shown that the effects of ASF can be devastating during the initial epidemic phase of infection in free populations; however, in the absence of effective contraction, the disease tends to go into an even more burdensome and long-lasting endemic phase, that needs to be tackled with equally appropriate tools for achieving the aim of eradication.

As has been mentioned, vaccines that can be used to prevent and limit the ASF infection are not yet available. In the past, in the Iberian Peninsula, attenuated vaccines have been used, but with unsatisfactory results; several laboratories are currently working on vaccine candidates, obtained using the most up to date biomolecular techniques, but whilst these appear capable of protecting animals from the illness, they are not yet as effective as preventing the spread of the infection (H. Zakaryan et al. 2016). It is therefore desirable to insist on research to increase knowledge about the complex immunological mechanisms caused by this virus which have not yet been clarified, and which hamper the availability of immunising tools that have been strategically relevant in eradicating other infections (i.e. CSF) in domestic and wild populations.

Meanwhile, every country must equip itself to confront the risk of introducing the ASF virus that looms across the entire continent of Europe. Implementation of specific emergency plans and training / awareness for veterinary services as well as farmers remain the pillars of preventive work when confronting this disease.

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Review of FMD situation in North Africa

Introduction

North Africa is located in a critical geographical position at a cross-road between sub-Saharan African countries, the Middle East and the European continent. This cross-road is essentially the Mediterranean basin which can be considered nowadays as a strategic political and economic corridor. It is also therefore recognised the centrality of the Mediterranean area in the framework of the development scenarios of international trade, especially in light of the changes in global economic relations and political conditions in the countries of south-eastern Mediterranean, which inevitably would lead to a review of the objectives, policy instruments and way of interactions between the countries bordering the Mediterranean basin including those relating to ensure a sustainable livestock production systems. In North Africa, a few kilometers away from Europe, there are animal diseases that if re-introduced in Europe (e.g. Foot and mouth disease) or introduced (e.g. Peste des petits ruminants), could have devastating effects on the animal population and linked generated sector's economy. In the Mediterranean basin, a platform for collaboration in the field of veterinary public health called REMESA (Réseau Méditerranéen de Santé Animale) has been operating; it encompasses the collaboration of 15 Mediterranean countries: eight belonging to the Middle East and North Africa (Morocco, Algeria, Tunisia, Libya, Mauritania, Egypt, Lebanon and Jordan) and seven in the south of Europe (Italy, France, Spain, Portugal, Malta Cyprus and Greece). The REMESA network is governed by a Joint Permanent Committee (JPC), made up of the Chief Veterinary Officers of the 15 adhering countries, by representatives from OIE and FAO, as well as representatives of regional and international organizations, namely European Union (EU) and Maghreb African Union (UMA). The Secretariat of the network is assured by the OIE and FAO Sub-Regional offices based in Tunisia. The main objective of the network is to improve the prevention and control against the major transboundary animal diseases and zoonoses through the strengthening of the national and regional resources and capacities. This is achieved through systematic exchange of experiences between countries and regular capacity building activities to promote the harmonization of animal diseases surveillance and reinforce the capacities of Laboratories and Veterinary Services for diseases that are considered as a priority for the countries (e.g. Foot and mouth disease, Peste des petits ruminants, Rift Valley Fever, Rabies).

REMESA extensively discussed the reoccurrence of FMD (serotype O) in Tunisia, Algeria and Morocco in 2014-2015 - after about 15 years of absence - by creating the major significant sanitary event in the North African region in the recent times. The detection of a new FMD serotype (A) in Algeria in 2017 demonstrates that this disease continues to be present in the region and imperil the livestock sector of North Africa. The objective of this article is to review the FMD situation within the epidemiological context of the entire North Africa region.

Animal movements in North Africa and recent incursions of FMD in the region

In North Africa, the livestock population is estimated to be about 7 million large ruminants and 75 million small ruminants (>12% of the small ruminant population of Africa). In this region, the movements of animals – especially at the borders – are frequent, regular and conducted mainly informally. Figure 1 illustrates the main patterns of the animal movements occurring in North Africa region since centuries for social, economic and religious purposes as well as the pathways of the recent incursions of different FMD strains in North Africa based on the samples analysed by OIE reference laboratories. The Figure highlights the fact that the zone ranging from Libya to Morocco – known to have high degree of borders porosity – could be considered as a unique epidemiological unit since these countries share a common risk factor, such as the animal movements without an effective traceability system in place. The figure highlights as the corridor from Middle East to North Africa (via Egypt and Libya) was in the recent years permeable to the introductions of FMD strains in 2009, 2010 and 2013 coming from Western Asia continent. Although in the Middle East there are countries that mainly import animals, it should not be neglected the

degree of connectivity of the animal's movement occurring between Middle East and North Africa (via Egypt and/or via Libya). Further introductions have occurred from East African countries. This pattern of incursions - at least in part - overlaps with the high concentration of animal movements entering into Egypt and Libya from Ethiopia, Chad, Niger and Sudan.

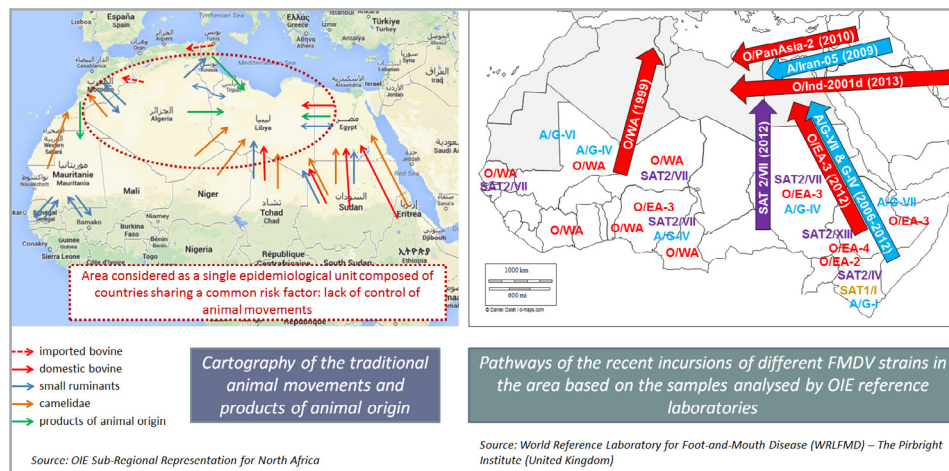


Figure 1. Main patterns of the animal movements/products in North Africa region and past incursions of different FMD strain

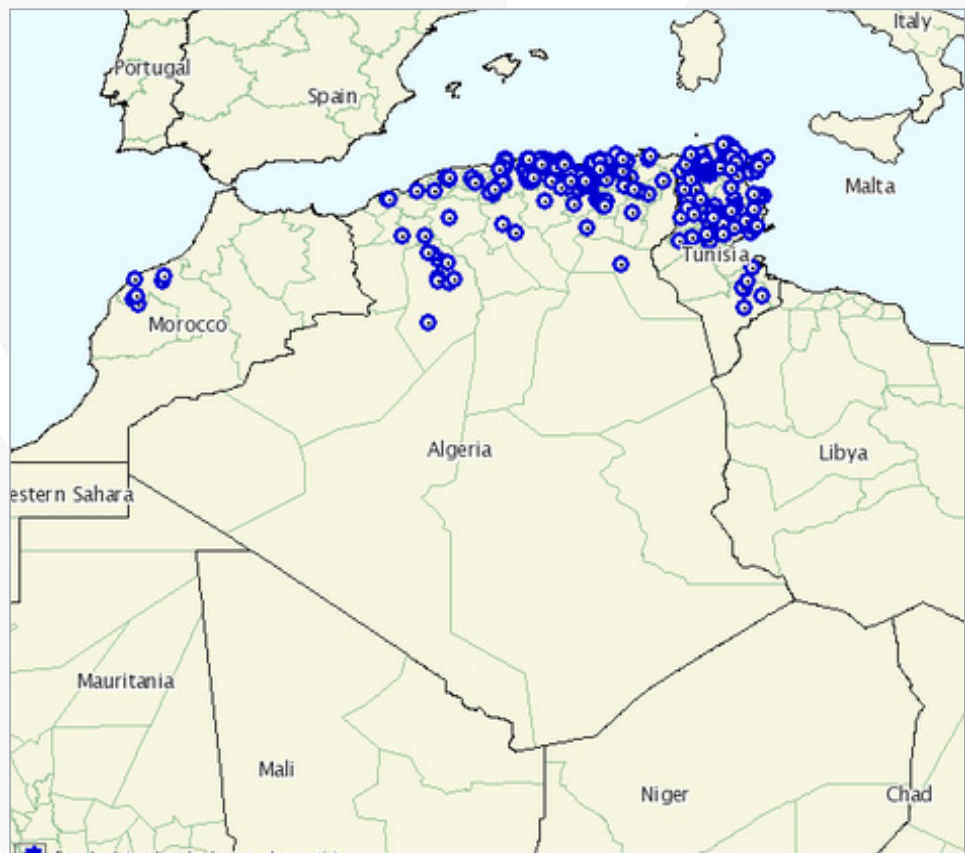
2014-2015: FMD epidemic in Tunisia, Algeria and Morocco

Based on the OIE immediate notifications, foot and mouth disease reoccurred in Tunisia (April 2014), Algeria (July 2014 and March 2015) and Morocco (October 2015) creating the major significant sanitary event in the North African region in the recent times. While recognising the presence of the disease in the neighboring countries such as Mauritania, Libya and Egypt (endemic vs intermittent reoccurrences), this disease was absent in these three countries in the period ranging from 1999 to 2014. The foot and mouth disease viruses - isolated from the outbreaks occurred in Tunisia, Algeria and Morocco (during the period 2014-2015) - were classified within serotype O, and the phylogenetic analysis on VPI coding sequences revealed that these viruses belong to the Ind-2001 lineage within the Middle East-South Asia (ME-SA) toptotype. The O/ME-SA/Ind-2001 lineage was initially identified in the Indian subcontinent in 2001 and subsequently became the predominant lineage in the region. Escape of this lineage from the Indian subcontinent has occurred sporadically, up to 2013, when viruses from outbreaks in Libya (September to November 2013) and Saudi Arabia (August to November 2013) were found to belong to the O/ME-SA/Ind-2001 lineage and phylogenetic analyses showed these viruses are most closely related to viruses from India, Nepal and Bhutan collected in 2013. These laboratory results provided evidence that a new FMD virus was introduced into Libya and that FMD outbreaks in Libya and Saudi Arabia have arisen through separate introduction of this virus in these two countries (Knowles et al, *Transboundary and Emerging Diseases* 2016, Valdazo-Gonzalez et al., 2014). To corroborate these results, there was an epidemiological investigation carried out by the Libyan Veterinary Services soon after the discovery of the new FMD serotype in their territory. This led to the conclusion that Libya used to import goats from the Middle East by plane and noting that goats were first imported from the Indian continent to Middle East and then (after only 24 hours stopping in Middle East) loaded in the plane to be exported to Libya. Figure 2 illustrates the potential pathway of the introduction of FMD strain O/ME-SA/Ind-2001 in North Africa via Libya in 2013. Owing to the long-standing interrelated animal movements - in particular between Libya, Tunisia, Algeria and Morocco - this exotic lineage of FMD introduced in Libya in 2013 spread, in turn, first to Tunisia (total outbreaks in 2014=142) then to Algeria (total outbreaks in 2014= 419 and a total outbreaks in 2015=12) and finally reached Morocco (total outbreaks in 2015=6) (Figure 3).

Figure 2.
Potential pathway of FMD virus introduction in North Africa



Figure 3.
FMD outbreaks notified to the OIE by Tunisia, Algeria and Morocco during the 2014-2015 epidemic



Based on the phylogenetic analysis carried out on both VPI and full genome sequences of the viral isolates obtained from Tunisia, Algeria and Morocco, the following major indications were reflected for the FMD epidemic occurred in 2014-2015 (Pezzoni et al., 2016):

- A unique introduction of the FMDV O/Ind-2001 lineage occurred in North Africa, in Libya in 2013, as suggested by evidence that all Libyan isolates share a common ancestor (estimated to be originated in July 2013);
- There was a single introduction from Libya into the Little Maghreb (Tunisia, Algeria and Morocco). In fact, all the Maghreb isolates were shown to derive from a unique putative common ancestor, estimated to be present since beginning of 2014;
- In Tunisia, the virus evolved in three main clusters, probably consistent with animal movements in the country;
- Two different introductions from Tunisia to Algeria have likely occurred, in 2014 and 2015 respectively; in fact, Algerian isolates from 2014 and those from 2015 cluster in different branches, together with different Tunisian isolates;
- The Moroccan isolate derived from viruses of the 2015 Algerian outbreaks, with which it shares a common ancestor.

However, major challenges were encountered to control the disease in North Africa:

- Difficulties to control animal movements;
- Difficulties in having immediate availability of appropriate vaccine;
- Absence - between countries - of an appropriate regional FMD vaccination strategy and other control measures (e.g. harmonised surveillance plans, stamping-out policy);
- Political instability occurring in Libya and the unknown animal health sanitary situation present in Libya. The latest available information on FMD is dated back to 2013. Tunisia established – for security reasons – a military zone at the border with Libya and animals coming from Libya and entering this restricted area are confiscated and – when serologically positive for FMD – are slaughtered. In 2016, about 6.000 animals coming from Libya were confiscated by Tunisia and 20% of them tested positive for FMD at the 3ABC ELISA test.

As mentioned, the control measures applied by the three countries (Algeria, Tunisia and Morocco) to face the incursion of the FMD strain O/ME-SA/Ind-2001 were different among the countries. However, the vaccination – although applied differently (see Table I) – was the main control measure that reduced the virus circulation of FMD strain O/ME-SA/Ind-2001 and the related clinical disease manifestation, mainly in cattle population.

Table I. Vaccination strategies against FMD in the Maghreb region

Country	Species	Serotypes
Algeria	Bovine	O - A (up to 2014)
	Bovine	O (2015-2016)
	Small ruminants	O- A (from the next campaign)
Marocco	Bovine	O (re-started again in 2014)
	Bovine	O-A (from 2017)
Tunisia	Bovine	A – O - SAT2
	Small ruminants	O - SAT2

2017: FMD in Algeria

In March 2017, Algeria notified to the OIE a new outbreak of FMD due to new strain in the country (serotype A) which caused clinical disease in cattle. Based on the information available through the OIE World Animal Health Information System (WAHIS), a total of 4 outbreaks due to FMD serotype A were reported in the North part of the country. The samples were submitted to the OIE reference laboratory of Brescia (IZSLER, Italy) for confirmation and for identification of the virus genetic lineage through sequences analysis. Phylogenetic analysis based on VP1 coding gene showed that the FMD virus serotype A detected in Algeria belongs to the A/Africa topotype, lineage G-IV which is endemic in sub-Saharan countries and the most closely related viruses are type A isolates from Nigeria (2015). The FMD World Reference Laboratory at The Pirbright Institute is going to perform vaccine matching tests in order to generate in-vitro information about the appropriate vaccine strain to be potentially used.

2017: FMD in Tunisia

On 27 April 2017, Tunisia confirmed the detection of an outbreak of FMD due to serotype A in Northern part of the country. In the affected farm, 17 cases were detected out of 22 susceptible animals and the clinical signs observed on the animals were fever, lameness, stomatitis, ulcers of all ages and salivation. In that farm, four bovines of unknown origin and bearing foreign identification marks were introduced and lately, illegal cross-border animal movements were registered. Five vaccination campaigns have been applied since 2014 and the last vaccination campaign was finalized in November 2016. A trivalent vaccine is available for cattle including the serotypes A, O and SAT2. From April to May 2017 a total of 2 outbreaks were reported by Tunisia (Figure 4).

Figure 4.
Outbreaks due to Serotype A
in Tunisia



The Table 2 shows the FMD serotypes that circulated in the Maghreb Region since the 1960s.

Table 2. History of FMD in the North Africa Region

Country	Year	FMD serotype
Algeria	1966 - 1990 - 1999	O
	1977	A
	2014-2015	O
	2017	A
Libya	1959 - 1960 - 1962 - 1967 - 1968 - 1972 - 1981 - 1982 - 1983 - 1988 - 1989 - 1994	O
	1979 - 2009	A
	2003	SAT2
	2009/2013	A-O-SAT2
Mauritania	1975 - 1976	SAT2
	1997	A
	2000	O
	2006	SAT2
Marocco	1991 - 1992 - 1999	O
	1977 - 1983	A
	2015	O
Tunisia	1965 - 1967 - 1969	C
	1970 - 1975 - 1989 - 1990 - 1994 - 1999	O
	1979 - 1982	A
	2014	O

International initiatives undertaken to support North African countries since the 2014-2015 FMD epidemic

During the 2014-2015 FMD epidemic, the EU, the European Commission for the Control of Foot-and-mouth disease (EuFMD) and OIE FMD Reference Laboratories [Brescia (Italy), Pirbright (UK) and ANSES (France)], provided support to the affected countries in the framework of regional cooperation and under the context of REMESA. The following initiatives were acted:

- procurement/donation of FMD trivalent vaccines [EU donated 1 million doses to Tunisia (on 21 August 2014) and 100.000 doses to Algeria (on 19 August 2014)];
- delivery of FMD diagnostic kits;
- genetic and antigenic characterisation of FMD virus isolates;
- designing and implementation of surveillance (harmonised survey) and field vaccine trials (vaccine effectiveness...);
- expertise during the technical workshops organised under the framework of REMESA;
- e-learning training through webinars;
- elaborating the document outlining the main elements to implement a regional FMD vaccination strategy for North African countries (be ready by the end of the first semester 2017);
- resolution was endorsed by REMESA to establish a FMD regional vaccine/antigens bank for North Africa;
- state of play of animal identification and traceability in North African countries by establishing a regional working group with the objective of elaborating a common regional strategy on animal identification and traceability.

However, in the absence of effective surveillance system and vaccination plans, North Africa remains constantly at risk of FMD incursions from Middle East and Sub Sahara with the high risk of becoming permanently endemic. The current political instability in Libya - causing also a significant lack of animal health sanitary information – represents one of the major challenges for the North African region in preventing and controlling animal diseases, including FMD.

In addition, the risk of introducing FMD into Europe from North Africa is not negligible and can be amplified if FMD becomes endemic in North African region. In this context, it should not be neglected the negative effects of the political instability in some countries adjoining the Mediterranean basin since the veterinary public health challenges cannot be isolated from matters related to political insecurity.

Therefore, in light of the reoccurrence of the serotype A of FMD in Algeria in 2017, it is imperative to continue to support the North African countries to control the disease and, in turn, the North African countries should speed up the implementation of the control measures and activities such as risk-based surveillance, harmonised vaccination strategy (also based on the risk) as well as to make significant progress on animal identification. In particular, it is fundamental to better:

- a) control traditional animal movements;
- b) implement investigation procedures in case of outbreak (trace back and forward); design surveillance activities;
- c) monitor the efficacy of the vaccination campaigns. Finally, it worth recalling that vaccination is an essential tool to control the FMD where it is endemic. The implementation of the OIE regional vaccine bank to allow quick and secure access to high quality vaccine is crucial. Appropriate vaccination programmes and post-vaccination surveillance are also vital to control and eradicate FMD.

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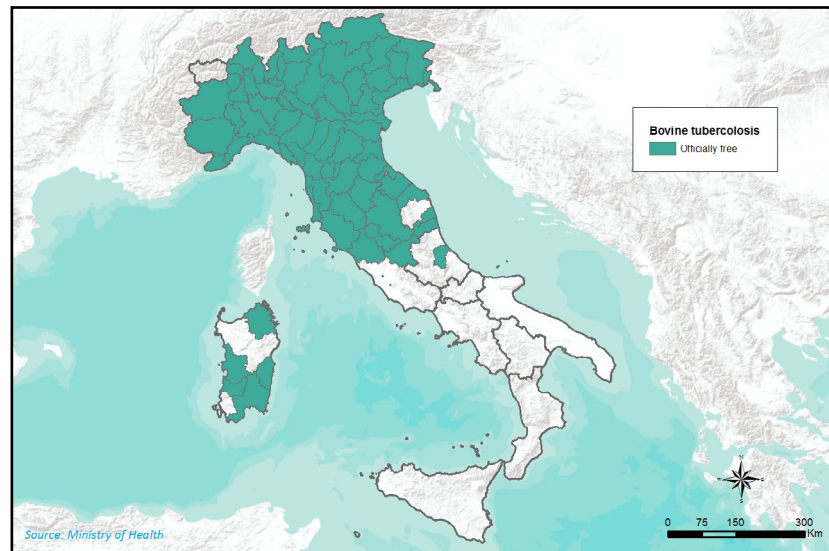


OFFICIALLY FREE TERRITORIES

Bovine tuberculosis: provinces and regions officially free according to the community legislation updated to up to 22th May 2017

Decision	Region	Province
2016/168/UE	Abruzzi	Pescara
	Emilia Romagna	The whole region
	Friuli Venezia Giulia	The whole region
	Lazio	Rieti
		Viterbo
	Liguria	The whole region
	Lombardy	The whole region
	Marche	Ancona
		Ascoli Piceno
		Fermo
	Piedmont	Pesaro-Urbino
		The whole region
	Sardinia	Cagliari
		Medio-Campidano
		Ogliastra
Olbia-Tempio		
Tuscany	Oristano	
	The whole region	
Trentino-Alto Adige	Bolzano	
	Trento	
2017/888/UE	Veneto	The whole region
	Umbria	The whole region

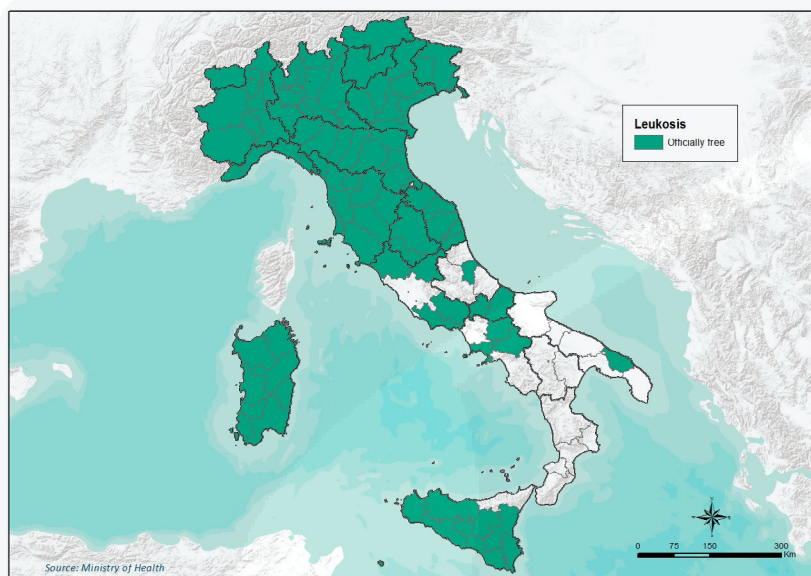
Bovine tuberculosis



Bovine leukosis: Provinces and Regions Officially Free according to the EU legislation updated to 11th October 2016

Decision	Region	Province
2014/91/EU amending annex III cap.2 of Decision 2003/467/EC	Abruzzi	Pescara
	Campania	Avellino
		Benevento
		Napoli
	Emilia Romagna	The whole region
	Friuli Venezia Giulia	The whole region
	Lazio	Frosinone
		Latina
		Rieti
		Viterbo
	Liguria	The whole region
	Lombardy	The whole region
	Marche	The whole region
	Molise	The whole region
	Piedmont	The whole region
	Puglia	Brindisi
	Sardinia	The whole region
	Sicilia	Agrigento
		Caltanissetta
		Catania
Enna		
Palermo		
Ragusa		
Siracusa		
Trapani		
Tuscany	The whole region	
Trentino Alto Adige	Bolzano	
	Trento	
Umbria	The whole region	
Valle D'Aosta	The whole region	
Veneto	The whole region	

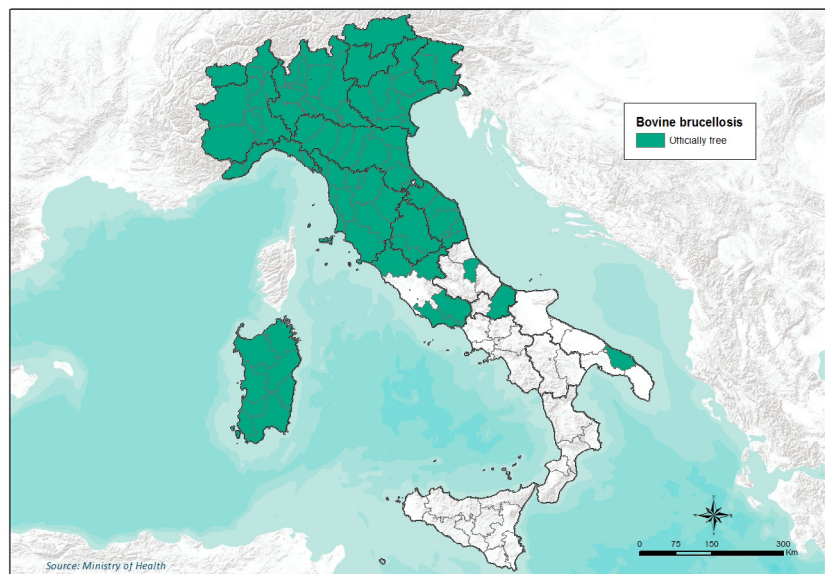
Bovine leukosis



Bovine brucellosis: Provinces and Regions Officially Free according to the EU legislation updated to 11th October 2016

Decision	Region	Province
2016/168/UE	Abruzzi	Pescara
	Emilia Romagna	The whole region
	Friuli Venezia Giulia	The whole region
	Lazio	Rieti
		Viterbo
	Liguria	The whole region
	Lombardy	The whole region
	Marche	Ancona
		Ascoli Piceno
		Fermo
	Piedmont	Pesaro-Urbino
		The whole region
	Sardinia	Cagliari
		Medio-Campidano
Ogliastra		
Olbia-Tempio		
Tuscany	Oristano	
	The whole region	
Trentino-Alto Adige	Bolzano	
	Trento	
2017/888/UE	Veneto	The whole region
	Umbria	The whole region

Bovine brucellosis

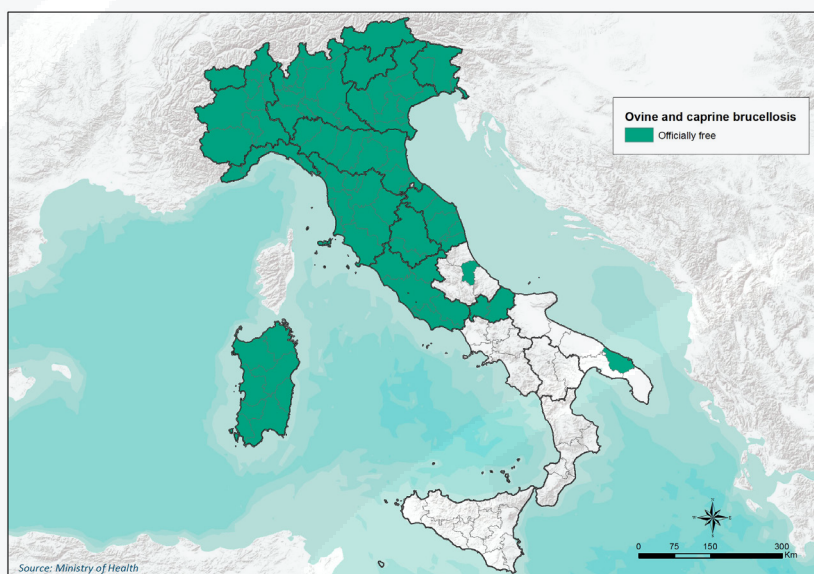




Ovine and caprine brucellosis: Officially Free according to the EU legislation updated to 11th October 2016

Decision	Region	Province
2014/91/EU amending annex II of Decision 93/52/EEC	Abruzzi	Pescara
	Emilia Romagna	The whole region
	Friuli Venezia Giulia	The whole region
	Lazio	The whole region
	Liguria	The whole region
	Lombardy	The whole region
	Marche	The whole region
	Molise	The whole region
	Piedmont	The whole region
	Sardinia	The whole region
	Tuscany	The whole region
	Trentino Alto Adige	Bolzano
		Trento
	Umbria	The whole region
Valle d'Aosta	The whole region	
Veneto	The whole region	
2016/1811/EU amending Annex II to Decision 93/52/EEC	Apulia	Brindisi

Ovine and caprine brucellosis





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