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

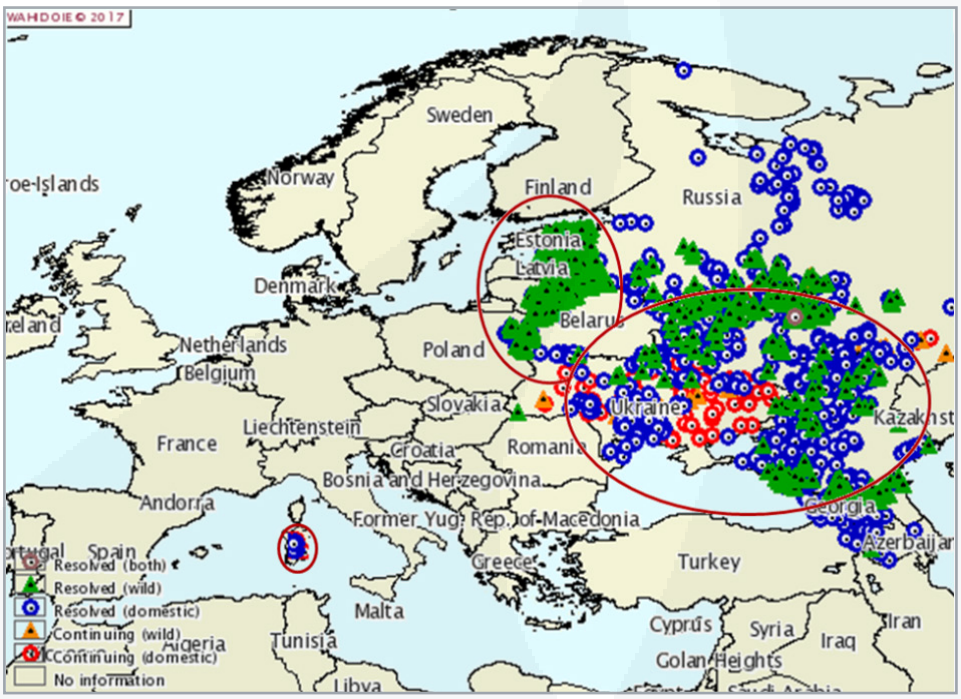
Background

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 *Ornithodorus*) 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 1: 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).

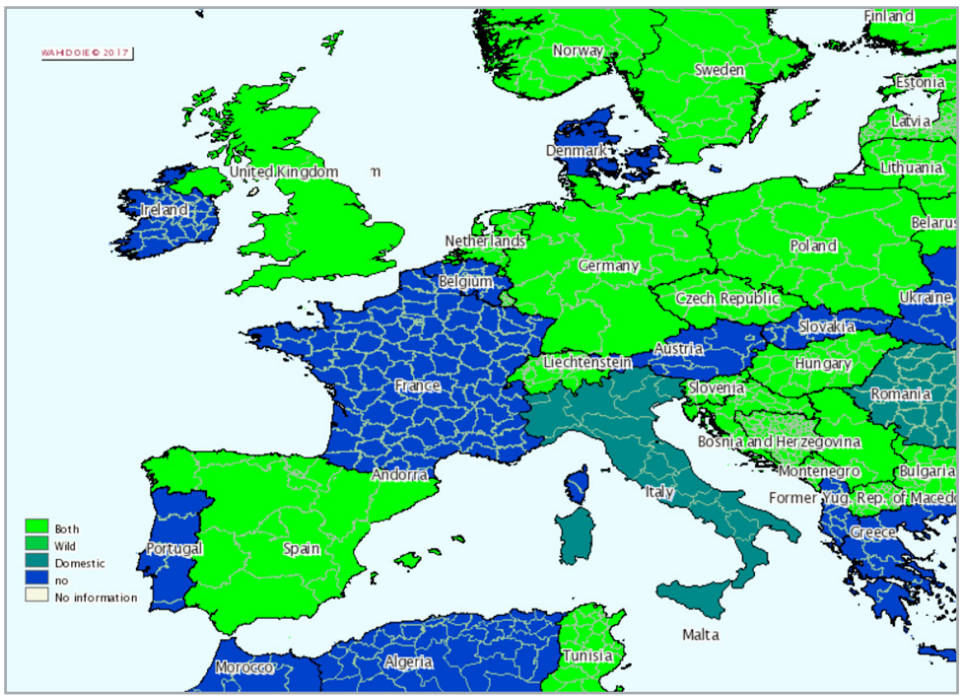


Figure 2.
Map of European countries that implemented measures to control the ASF among domestic and/or wild pig population (OIE data)

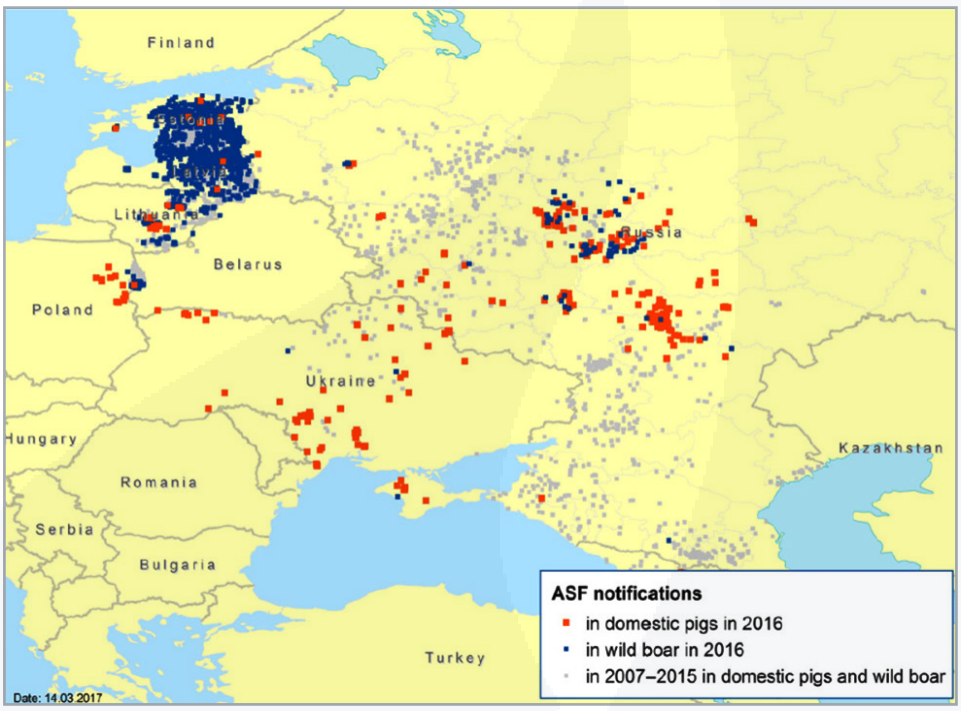
Scenario: Northern Europe (EU member states)

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).

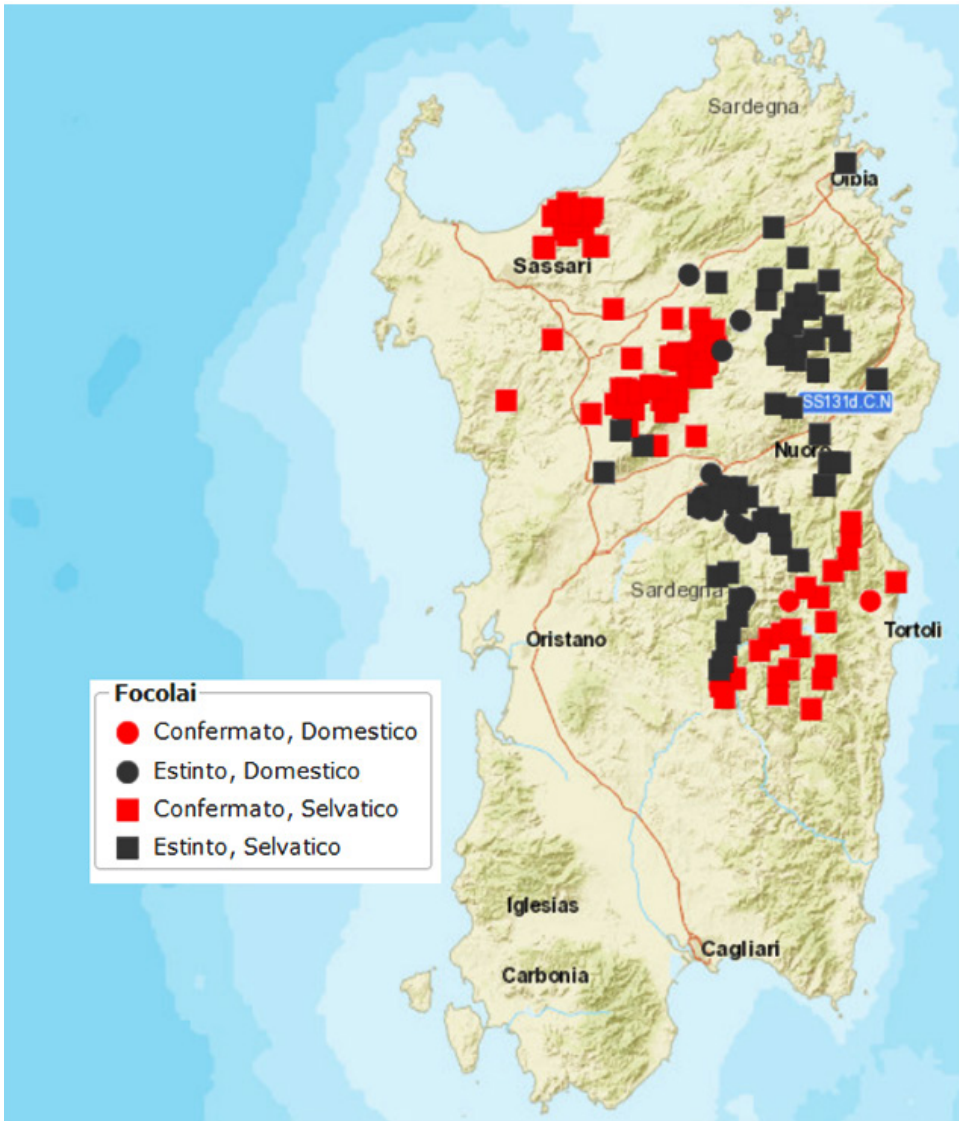


Figure 4.
ASF outbreaks notified in Sardinia region during the 2016 (SIMAN data)

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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