EMPRES WATCH
emergency prevention systems

African swine fever in the Caucasus

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1. INTRODUCTION

African swine fever (ASF) is caused by a DNA virus, *Asfivirus*, currently the sole member of the Asfarviridae family. It is a highly contagious virus infection of domestic pigs, but can also be acquired through the ingestion of contaminated feedstuffs and transmitted by certain tick species. ASF has a serious socioeconomic impact on people's livelihoods, participation in international commercial trade, and protein-food security. Feral pigs (escaped domestic species) or European wild boar (non-domesticated species) are equally susceptible to ASF, which makes it very difficult to control the disease if the infection becomes endemic in these populations. Humans are not susceptible to ASF infection.

The potential distribution of the infection is transcontinental; it can occur wherever swine are raised, and therefore most countries free of the infection take serious measures to prevent its entry. The disease is endemic in domestic and wild porcine species in most of sub-Saharan Africa and Sardinia (an Italian island in the Mediterranean). Where the infection occurs, pig production is usually sustainable only by adoption of high biosecurity levels on individual holdings.

Outbreaks of ASF were reported in 2007-2008 in the Caucasus region for the first time and are likely to spread further to eastern Europe or other areas where swine are raised.

2. ABOUT THE VIRUS AND THE DISEASE

In a suitable protein environment, the ASF virus, is stable over a wide range of temperatures and pH. Putrefaction does not necessarily inactivate the virus. The virus may remain infective in faeces for at least 11 days and in bone marrow for months. When not protected, ASF virus is rapidly inactivated by sunlight and desiccation. As a result of its tolerance to a wide pH range, only certain disinfectants are effective against the virus.

African swine fever affects all ages of pigs, without sex predilection. Pigs become infected mainly through the oro-nasal route after contact with infected pigs or through feeding of virus-contaminated products (swill and garbage waste). In areas where competent vectors of the *Ornithodoros* tick genus exist, transmission via these vectors can be important for virus persistence in an area. Maintenance of ASF virus in domestic pigs in the absence of *Ornithodoros* ticks is probably dependant on the existence of large, continuous populations of pigs whose high reproductive rate ensures constant availability of naïve pigs for infection and further spread. Aerosol transmission has been shown to occur only over very short distances. Spread via fomites - contaminated vehicles, equipment, instruments, clothing, and even insects – is likely when there are high levels of environmental contamination. Waterborne transmission is most unlikely because of dilution of the virus.

The virus is relatively stable in the excretions of infected pigs, in pig carcasses and in some pig meat products and fresh pig meat. The ASF virus is resistant to the decrease of pH which accompanies the meat maturation process, and it is not inactivated by freezing or thawing. The ability of the virus to remain infective in edible products such as chilled meat (at least 15 weeks, and probably longer if frozen) and from three to six months in cured hams and sausages that have not been cooked or smoked at a high temperature has important implications for spread of ASF. Undercooked pork, dried, smoked and salted pork and blood or carcasses/carcass meal derived from pigs in an outbreak or endemic setting must be regarded as potentially dangerous if fed to pigs and/or discarded in communal waste sites where pigs may feed. However, cooked or canned hams are safe, as long as they have been heated throughout to 70°C for more than 15 minutes.

After infection with the ASF virus, domestic pigs may shed infective amounts of virus for 24–48 hours before clinical signs appear. During the acute stage of disease, enormous amounts of virus are shed in all secretions and excretions and high levels of virus are present in tissues and blood. Pigs that survive the acute disease may remain infected for several months, but do not readily shed virus for more than 30 days.

The incubation period varies from 5 to 15 days. Although different serotypes cannot be identified, ASF virus strains differ in virulence, leading to acute, sub-acute and chronic forms of ASF. Clinical disease is usually peracute or acute, and the morbidity and mortality rates

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within an affected holding may approach 100 percent. In pigs which clinically recover, viraemia may persist for several weeks, and recovered animals present a risk since the virus has been isolated from tissues up to six months post-infection.

The development of high fever (>40°C) is usually the first clinical sign, which is accompanied by depression and loss of appetite. Sows may abort at all stages of pregnancy (Note: and be a source of virus to other pigs in the holding). However, from clinical examination, ASF can only be suspected as several diseases can produce similar clinical signs. Pathological findings revealing extensive haemorrhages in lymph nodes, spleen and kidneys may be additional indicators for the presence of ASF. A final diagnosis can only be done through laboratory testing. Detailed instructions for laboratory diagnostic procedures for ASF can be found in the OIE Manual of Standards for Diagnostic Tests and Vaccines for Terrestrial Animals - Chapter 2.1.12. (http://www.oie.int/eng/normes/mmanual/A_00035.htm).

Antibodies against ASF are detectable in serum 7–12 days after clinical signs appear and persist for a long time post-infection, possibly for life, in both warthogs (in Africa) and domestic pigs. They do not fully protect against subsequent infection in domestic pigs, although a degree of immunity to infection with homologous strains of virus has been reported. Serologically positive sows transmit antibodies to piglets through the colostrum. In sub-acute and chronically infected pigs, virus replication continues even in the presence of antibodies.

GEORGIA

Although ASF was not reported to the OIE until 5 June 2007, the first clinical cases were seen before May 2007 in the area surrounding of the port of Poti, on the eastern shore of the Black Sea. All evidence so far indicates that the virus was probably introduced into Georgia by improperly disposed waste from international ships carrying contaminated pork or pork products. Since most pigs in Georgia are traditionally kept on a free range, scavenging system, access to dumped port waste is likely. Afterwards, the disease spread eastwards and north following the main transportation routes.

This was the first official report of ASF occurrence in the Caucasus region. Sequence analysis of the Georgian ASF virus isolate revealed a close relationship to virus strains from Southeast Africa (Mozambique, Madagascar and Zambia).

Early detection was based mainly on clinical findings and only a small proportion of these outbreaks were confirmed by laboratory investigations. Delayed recognition and response to the new disease appears to have allowed infection to become widespread. By the second week of June, 52 out of 65 districts were suspected to be affected, more than 30,000 pigs had died and a total of 3,900 pigs had been culled. However, it was reported that only clinically ill animals within an infected herd had been culled, which may have contributed to ASF persisting and becoming endemic in the country. Most pigs affected were on open grazed fields or in free range systems. During January 2008, active infection was reported from three regions.

ARMENIA

Armenia first reported ASF on 6 August 2007 in the northern districts bordering Georgia. The source of the ASF virus entry into Armenia was probably the ASF epidemic in Georgia. It may have entered Armenia through legal or illegal movements of pigs and pig products, or from the movement of free-ranging pigs or wild boar across the border.

To date, however, there is insufficient information to identify the exact route of virus entry. Potential transmission routes include persons who had visited affected premises in Georgia, swill feeding, meat scraps at picnic sites, contact with infected pigs or contaminated fomites.

By 25 November 2007, the number of suspected ASF cases in the two northern districts of Armenia had risen to 41. In total, around 3,600 pigs died of ASF and 4,300 were culled (Figure 1). During November 2007, new outbreaks occurred in Yerevan and Ararat districts (Figure 1). However further spread is almost certain to occur within and beyond the currently affected areas. During January, no outbreaks were reported, but one case was diagnosed in February 2008.

RUSSIAN FEDERATION

On 4 December 2007, the Russia Federation reported to the OIE its first ASF outbreak since the 1970s. The report stated that five wild boar in the Republic of Chechnya, bordering Georgia (Figure 1) were positive.

Although the precise method of introduction into the country is unknown, it is likely to have been related to the outbreaks in neighbouring Georgia. If wild boar become infected, the virus could potentially become endemic in the region, as occurred on the Iberian Peninsula and occurs in Sardinia today. So far, the competency of possible *Ornithodoros* tick vectors in the affected regions is unknown.

AZERBAIJAN

ASF was officially confirmed in Azerbaijan on 28 January 2008 in the village of Nic, Gabala District (northwest of the country, about 180 km east of the Georgian border, Figure 1). The majority of the inhabitants of Nic are Christian, explaining the relatively high number of pigs (4,600) in the village compared to other villages. The pigs were typically kept in backyard holdings and temporarily left outside during the day on pasture/communal land. In Azerbaijan, pigs are kept mainly for family consumption or small-scale local trade.

The local veterinary services believe that the ASF virus was introduced into Nic either by contaminated pork (or pork products) from Georgia or by infected wild boar at the beginning of January. However, the wild boar hypothesis is questionable since no infected wild boar have been found so far in Azerbaijan or Georgia. The

Figure 1. ASF situation in the Caucasus region (June 2007 to February 2008)

Source: National authorities *Credit:* FAO/Lorenzo De Simone

hypothesis of virus introduction via infected pork or pork products from Georgia is thought to be more likely.

Nagorno-Karabakh has been experiencing ASF outbreaks since November 2007

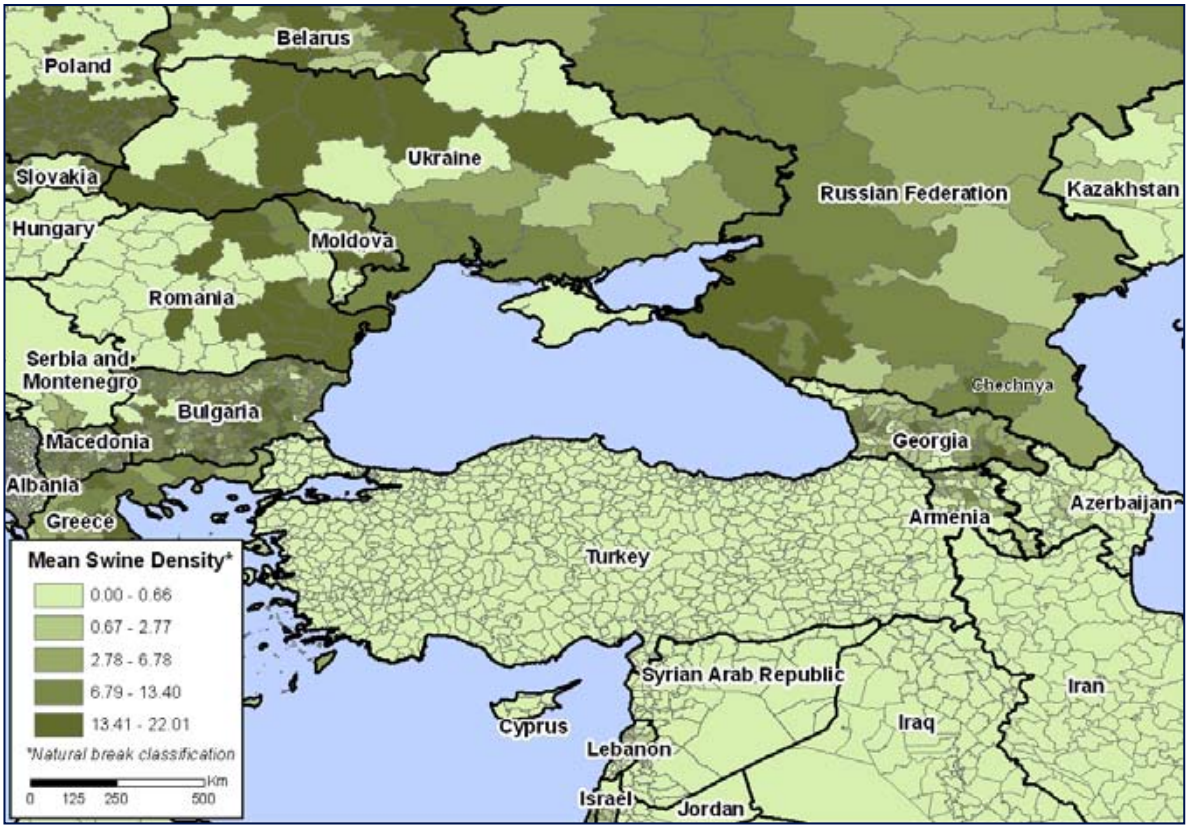
3. THE PIG INDUSTRY IN THE CAUCASUS

Estimates of the pig population in Armenia range from 300,000 to over one million head, mainly in the north of the country. In 2005, Georgian swine production totalled almost 500,000 head, with the highest pig densities found in the east and western parts of the country (Figure 2). Few pigs are reported in the mountainous areas along the border with Russia or along the borders with Turkey and Armenia. Pig breeding in Armenia and Georgia is seasonal (spring, summer and fall), with few if any piglets born during winter. The peak period for pig slaughter is Christmas/New Year. This means that pig inventories are at their lowest in January, when most of the remaining animals are adult breeders, and highest during the summer months (June-August), when the population size will be several times that of January. Moreover, in the absence of a herd registration or animal identification system, it is most likely that the inventories are underestimated. There are purportedly financial disincentives (e.g. taxation) against the full reporting of pig populations. The economic importance of pig production is, therefore, estimated to be greater than official statistics indicate.

Pig production systems vary across the Caucasus countries. The majority of pigs are kept in small backyard holdings, where there is lack of continuous containment of pigs and free roaming and scavenging are widely practised. Pigs let out during the day return to their housing at night to be fed. About 90 percent of the pigs in Georgia are backyard, kept in non-professional pig holdings with 1-2 pigs each. In Armenia, the situation is similar. In a limited area close to the border with Georgia, there is a substantial forest area where pigs are effectively feral throughout spring until they are brought back to their housing towards the end of autumn, to be confined and fed during the winter (Figure 3). In the southern and central areas of the country, backyard pigs are mostly fully confined in purpose-built housing. Traditionally, backyard pigs are traded either on free markets or through direct contact with potential customers.

There are also some semi-professional farms holding a few hundred pigs under full confinement in specialized premises which, in Armenia, tend to be close to the major market of Yerevan. However, a commercial pig

Figure 2. Swine density in Eastern Europe, the Caucasus and the Middle East



Source: FAO GLIPHA - Gridded livestock of the world 2007 *Credit:* FAO/Lorenzo De Simone

production system with high standards of biosecurity is rare. Though there are few formal pig slaughterhouses, most butchering is carried out on the premises of origin, even in the larger commercial farms.

Rearing pigs is common and a traditional practice in rural areas. It represents an important source of meat for the population in the countryside and often generates valuable cash income. The impact of swine diseases on livelihoods, particularly those of the poorer smallholders, is severe. Without compensation in the event of incursion of an epidemic disease, for which rapid reporting and response is required, owners will lose their entire investment.

In Azerbaijan, pig keeping and the pig industry are rather unimportant compared with Georgia and Armenia, since the majority of people are Muslim and pork consumption is limited to Christian minorities. Nevertheless, about 50,000 pigs are kept in Azerbaijan and the country is planning to increase pig production 10 times during the coming years. Wild boar are found in Azerbaijan and Chechnya, and they are also hunted, but no data regarding the numbers hunted or their distribution and density are available. As with Azerbaijan, Chechnya in the Russian Federation is predominantly Muslim.

4. MAIN CHALLENGES IN THE AREA AND THE RISK FOR THE REGION

The spread of ASF within the region was facilitated by late detection of the disease and limited ability of the veterinary services to control swine movement or marketing practices. As a result, the chance of ASF becoming endemic is high. Even with a late aggressive response, finding all free-ranging pigs and eliminating the disease in this population will be difficult.

If not contained, ASF could easily spread to other countries in the region and would have a protracted direct effect on the productivity of the livestock industry, and indirectly on the food supply and thus food security.

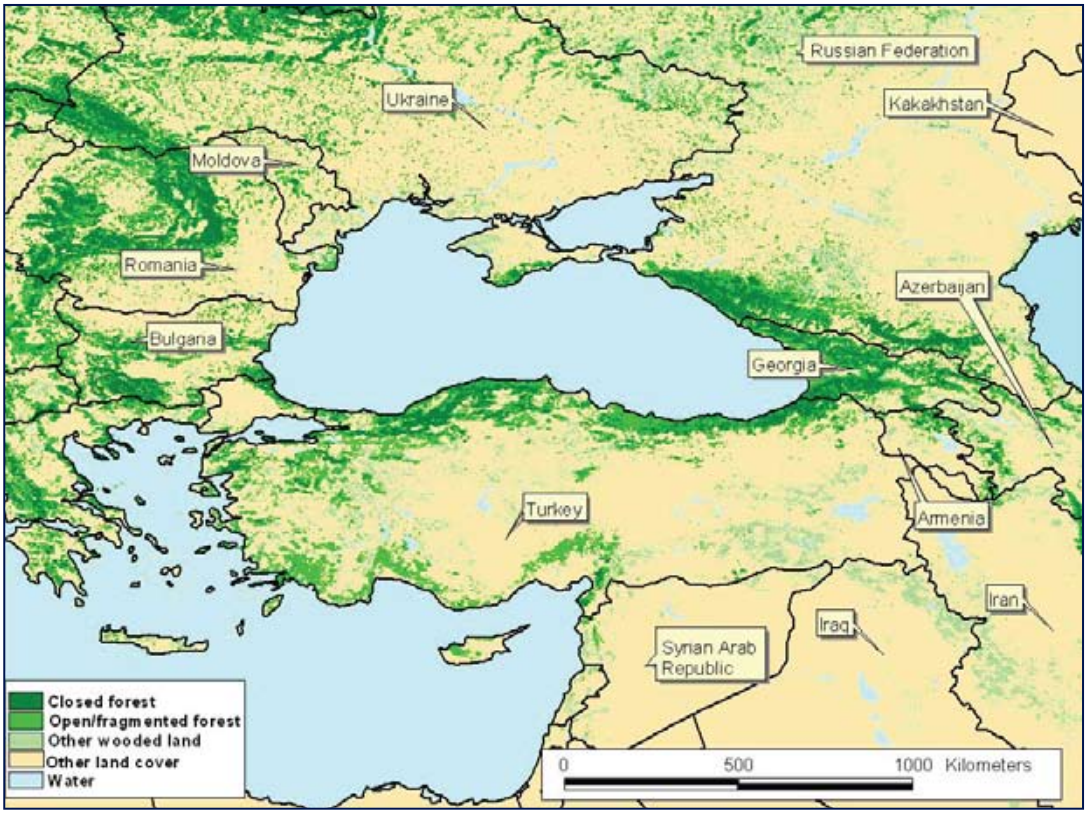
As shown in Figure 2, the countries to the south and east of the Caucasus region (Turkey and Iran), are predominantly Muslim with negligible pig populations other than in some isolated Christian communities. Therefore, the main risk of ASF spread is to the north and east (Russian Federation and Ukraine).

Infection in the wild boar population would complicate short and long term control. Wild boar might contribute to the spread of the virus since movement of wild boar between regions and countries cannot be controlled. Although wild boar usually do not migrate, they will move great distances if pressed to do so (for example, by extreme weather conditions). There are few reliable data on wild boar populations and densities in the Caucasus area. However, wild boar distribution is closely linked to the forested areas they inhabit (Figure 3). Little is known about the potential role of wild boar in the spread and persistence of ASF, since this type of scenario has only been observed in Sardinia and Spain. However, for a disease with a lethality as high as that observed for ASF, it is reasonable to assume that a relative high wild

boar density is needed to maintain the infection, which appears not to be the case in the Caucasus region.

In addition to the above difficulties, potential vectors (*Ornithodoros* ticks) may be present in the Caucasus region. Should competent vectors be identified, additional efforts would be needed to change household and commercial practices, further complicating the control of infection since infection in these arthropods hosts may persist for several year or even decades. The presence of these vectors in and around pig pens, their biting habits and vector competence must be investigated.

Figure 3. Map of forested areas in the region



Source: FAO - The World's Forests 2000 *Credit:* FAO/Lorenzo De Simone

Prevention and control measures for ASF and other infectious diseases of swine

No vaccines or drugs are available to prevent or treat ASF infection. Therefore, it is particularly important that ASF-free areas be maintained free by preventing the introduction of the disease. All control and eradication measures applicable are based on classical disease control methods, including intensive surveillance, epidemiological investigation, tracing and stamping out of infected herds (not just single individual animals that show clinical signs). These measures are combined with strict quarantine and biosecurity measures and animal movement control.

Prevention

Import quarantine policy: The OIE Terrestrial Animal Health Code (2007 edition, Chapter 2.6.6) provides guidelines for the safe importation of domestic and wild pigs, pork and pork products, pig semen, embryos and ova and other products incorporating pig tissues, such as pharmaceuticals. Attention should be paid in providing adequate regulatory and quarantine services to intercept foodstuffs and other risk materials containing pig meat or products being brought into the country at international airports, seaports and border crossing points. Any confiscated quarantine risk materials should be disposed of safely by deep burial or incineration, as should all food waste from international aircraft and ships, and not dumped where it can be accessed by scavenging animals.

Swill feeding controls: Swill feeding is a high risk practice, as several diseases can be introduced into an otherwise healthy population. Pigs should not be fed swill that might contain remains of pigs. Communication campaigns should target pig owners, so that they understand the dangers of swill feeding and opt to boil swill for 30 minutes and allow it to cool before feeding it to their pigs. It is advisable to place a ban on swill feeding, although compliance at household level is far from likely.

Containment of pigs: The development of properly constructed pig pens should be encouraged to reduce the numbers of scavenging pigs accessing garbage and coming into contact with feral pig populations or wild boar, particularly in areas which are considered to be at high risk for entry of ASF. However, traditional ways of keeping pigs in many countries will not be changed overnight as many producers will not find it worthwhile to confine their pigs.

Awareness: Pig farmers and field personnel should be made aware of ASF, be able to recognize ASF and know what to do if they suspect ASF.

Control

Surveillance: Intensive surveillance based on clinical inspections, necropsies (autopsies), serology and owner or hunter reporting should be done on all suspect cases, premises and their dangerous contacts for at least 40 days (the maximum incubation period) after the last date of possible transmission. Passive surveillance and reporting should be encouraged among pig owners through awareness campaigns. Whenever an infected pig holding is identified, the origin of the disease should be investigated (trace-back) and contacts should be investigated. In order to determine the extent of infection, it is also advisable to carry out retrospective examinations of slaughterhouse records (for high condemnation rates due to fever or lesions), and of samples sent to laboratories from ASF-like outbreaks.

Quarantine and movement control: Strict quarantines should be imposed on all suspected or infected premises as soon as possible. No movement of pigs, pig products and other potentially infected materials should be allowed off the property. No one should leave the farm without changing clothes and footwear. In a free-ranging or village situation, pigs should be enclosed.

A restricted area (RA), usually a 3 kilometre radius, includes the affected (infectious) premises and some or all of the dangerous contacts and suspect premises; a control area (CA) is a buffer zone around the RA. The implementation of RAs will prevent disease spread, because movement in the most likely affected premises is restricted. Movement of potentially contaminated materials can be allowed within a CA but not to the outside, unless previously approved. Premises of different status may have different movement restrictions, e.g. total prohibition of movement, movement of pigs to slaughter only, or movements to another property only if previously inspected and tested.

Biosecurity: Farmers should be encouraged to enhance their biosecurity levels: visitors kept to a minimum, perimeter fencing, removal of effluent, pig-loading and unloading facilities located outside the perimeter fences, and cleaning and disinfection of pig-carrying trucks after unloading. Perimeter fencing will prevent the spread of disease from domestic to feral pigs and vice versa. Under ideal settings, double fencing (at least 1 metre apart) is preferred. The access of wild pigs to domestic food scraps should be prevented. Village settings, where pigs may roam freely, present additional biosecurity challenges although the same biosecurity principles apply. Equipment and premises should be periodically cleaned and disinfected. Sharing of equipment among farms/villages should be discouraged, unless proper cleaning and disinfection is performed. Pig owners/workers should avoid contacting other pig populations and the use of dedicated work clothing and foot gear strictly promoted. Replacement breeding stock should come from trusted sources that deal in healthy animal trade. Casual visitors to the swine holding, particularly those who have contact with pigs, should not be allowed. A sign at the farm/village entrance advising visitors not to come close to pigs is also recommended. Entrails and other discarded parts from slaughtered pigs should be disposed of in an appropriate manner such as composting, burying, rendering or burning. When the disease is present in an area, decontamination equipment should be made available at village and premises entry and exit points (disinfectant, brush and a bucket of water or a foot bath).

Zoning: If the disease is endemic in only part of a country and it is possible to establish diseased and disease-free zones and enforce tight controls on the movement of pigs and products between zones, then zoning can be an important component towards progressive elimination or eradication efforts.

Stamping out and disposal: Culling or "stamping out" is often rejected by pig owners if there is no compensation programme in place, and this may contribute to dissemination of the disease through uncontrolled or illegal movement of diseased animals. The carcasses of destroyed pigs must be disposed of in a safe manner after stamping out is completed. Carcasses must be burnt or buried deeply, on-site if possible. This will prevent them from being cannibalized by feral pigs, scavenging animals, or moved away from the disposal site. The disposal of very large numbers of pigs in a short time presents environmental and logistical problems. Reference should be made to the FAO Manual on procedures for disease eradication by stamping out for more information on on-site slaughter and disposal procedures (http://www.fao.org/DOCREP/004/Y0660E/Y0660E00.HTM).

Cleaning and disinfection: The cleaning of organic matter from sheds, equipment, vehicles, etc. is the most important step before disinfection. Vehicles and personnel (shoes, clothing and equipment) should be disinfected on entering and leaving farms. The proven disinfectants are detergents, hypochlorites, alkalis, Virkon™ and glutaraldehyde.

Ensure that the use of disinfectants meets regulatory requirements, as some of these disinfectants may have residual effects or prove damaging to the environment. Equipment which cannot be easily disinfected should be either replaced or put aside and exposed to sunlight.

Vector control: Blood-sucking insects can mechanically spread ASF virus within herds. Therefore, an insect control programme should be implemented on all infected premises.

Sentinel animals and restocking: Depopulated premises should be initially restocked at least six weeks after cleaning and disinfection with seronegative sentinel swine, which are closely monitored to detect re-infection – clinically, virologically and serologically.

Public awareness: ASF outbreaks should be well publicized, emphasizing the dangers of swill feeding, particularly to small pig holders. Commercial farms should be encouraged to enhance their biosecurity levels. An early warning system encouraging farmers to inspect susceptible animals regularly and to report suspicious lesions and unusual deaths promptly should be implemented in every state or region and at national level. The public must not panic into avoiding wholesome meat products. Ensuring the cooperation of pig owners can be facilitated through information/awareness campaigns at village level meetings. Civil administrative authorities should also be put on a state of alert with periodical epidemiological information.

Wild animal control

If ASF were to become established in feral pig or wild boar populations, it would be much more difficult, if not impossible, to eliminate. Accordingly, the strategy should be to minimize contact between feral pigs and domestic pigs by double-fencing piggeries, eliminating or reducing the numbers of feral pigs in areas where domestic pigs are held, and immediately disposing of carcases, entrails or other discarded parts to prevent their consumption by feral pigs or other scavengers.

If, despite these methods, the disease became endemic in wild boar, there is no agreement on the best ways to control it. Hunting pressure may be counter-productive, since it may increase the size of the home-range and force long-distance movements. Besides, hunting management does not always reduce the population of wild boar. Supplementary feeding, while maintaining wild boar within a known, well-defined areas and limiting dispersal, will increase the opportunity for close contact and disease transmission. Where hunting is regulated, hunters and hunting clubs can be important collaborators for the veterinary services in their surveillance efforts.

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