African swine fever (ASF) in wild boar populations - research results and recommendations for control

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Research conducted by the Mammal Research Institute, Polish Academy of Sciences and collaborating institutions on wild boar ecology immediately prior to the occurrence of ASF in Europe and on the epidemiology of this disease immediately after its appearance in Poland has yielded new insights into the mechanisms of ASF spread and persistence in wild boar.

In Europe the wild boar is the only wildlife species directly affected by ASF (fot. Adam Wajrak)

African swine fever (ASF) is an infectious viral disease of wild and domestic suids that causes very high mortality among infected animals. In Europe and Asia the ASF epidemic has led to serious social and ecological consequences and huge economic losses. Despite the growing knowledge about the epidemiology of this disease, its control is too often reactive, unsupported by current scientific knowledge and does not propose comprehensive solutions.

Since the beginning of the ASF epidemic in the European Union in 2014, the Mammal Research Institute of the Polish Academy of Sciences, in cooperation with the National Veterinary Research Institute in Puławy (Poland), United States Department of Agriculture (USA), and Animal and Plant Health Agency (UK), has been conducting research on the

epidemiology of ASF in the wild boar (*Sus scrofa*), which is the natural reservoir of the ASF virus.

The results of these studies allow us to better understand the mechanisms of disease spread and to formulate recommendations for ASF control.

Factors influencing the spread of ASF in wild boar populations

1) Wild boar movements have a negligible impact on the spread of ASF, which is local, gradual and slow (Podgórski et al. 2018a). Wild boars are sedentary and contacts between individuals that lead to virus transmission are limited to animals living in the same or neighboring social groups (Podgórski et al. 2018b). The low mobility of wild boar, their group-based social structure and the high virulence of the ASF virus limit the rapidity of epidemic outbreaks, which was reflected in the observed slow spread of the disease through the wild boar population. ASF in wild boar spreads gradually due to the continuity of populations, rather than by leaps as a result of long-distance movements of wild boars (Podgórski et al. 2020, Taylor et al. 2020).

2) The probability of ASF occurrence in wild boar depends on population density and landscape structure. High abundance of wild boar is an important factor increasing the chances of ASF occurrence, rate of spread and persistence. ASF occurrence in large and compact woodlands was found to be twice as high as in field-forest mosaic landscapes and five times higher than in open areas (Podgórski et al. 2020, Pepin et al. 2020). The available data did not allow the determination of a strict wild boar density threshold for spontaneous disease fade out. However, statistical simulations indicate that the rate of ASF spread should decrease when their density is below 1 individual/km^2.

3) The probability of detecting an ASF-positive wild boar decreases sharply with distance from previous cases of the disease, reaching a minimum level about 40 km away from them (Podgórski et al. 2020).

4) Contacts of healthy animals with contaminated carcasses is an important mechanism of ASF transmission; it is responsible for 53 to 66% of virus transmission events and is necessary for autonomous persistence of the disease in the wild boar population. This route of indirect infection becomes predominant when wild boar numbers are low and is then prerequisite for long-term (> 1 year) persistence of ASF. Transmission by direct contacts allows the disease to persist for extended periods only at high wild boar densities or when there is a constant influx of new infections (Pepin et al. 2020).

5) Dead wild boars infected with ASF are most often found in humid environments, near watercourses and in shaded areas. These places were usually located away from the areas chosen by wild boars for rest, which is where carcass search is often carried out (Morelle et al. 2019).

6) ASF causes high mortality in the wild boar population, which greatly exceeds hunting harvest. Data from Białowieża Forest showed a decrease in numbers by 80% in the non-hunted area of the national park one year after the outbreak of the epidemic; in the hunted area, a fourfold increase in hunting only caused wild boar numbers to decline by an additional few percent on top of the mortality caused by ASF (Morelle et al. 2020).

GPS collars were used in the study of wild boar (photo by Tomasz Kamiński)

Recommendations for the control of ASF in wild boar populations

1) The chances of detecting infected animals are highest in areas with continuous and abundant wild boar populations, such as extensive woodlands (Podgórski et al. 2020). Concentrating ASF control activities, such as culling, carcass removal or fencing, in these areas increases the chances of successfully limiting disease outbreak size and spread.

2) ASF control actions should be focused around previously identified cases, and their intensity should decrease with distance from the infected area, according to the spatial distribution of the probability of an ASF case in wild boar (Podgórski et al. 2020). This

approach is in line with the system of zones surrounding ASF occurrence areas that has been used so far, in which various measures to reduce the spread of the disease are carried out (see below).

3) High abundances of wild boar increase the chances of ASF occurrence, spread and long-term persistence, which show the need for reducing densities to control the disease. Reduction should be carried out in a zoned system, focusing in particular on a buffer zone adjacent to the infected area (EFSA 2020). Hunting in the infected zone should be avoided due to the small effect on population reduction relative to ASF-induced mortality and the risk of further spread of the virus by animals moving outside of the ASF infected area in response to hunting disturbance. Due to the lack of reliable empirical data on the actual population densities of wild boar, setting target density thresholds for eradicating ASF is currently unjustified.

4) Contact of healthy wild boars with infectious carcasses is an important mechanism of ASF virus transmission (Pepin et al. 2020). Systematic search and removal of wild boar carcasses should be a basic tool in the control of ASF, especially in infected areas where mortality from ASF is high and carrion abundant. Removal of dead wild boar helps reduce viral load in the environment and limit disease persistence in the population. The role of the indirect, carcass-based mechanism of ASF transmission increases at low wild boar densities. Therefore, intensity of carcass search should be increased when population numbers decrease as a result of ASF-induced mortality and culling.

5) Information on landscape structure can be useful in developing an eradication strategy and designating an ASF control zone. For instance, areas with highly fragmented suitable wild boar habitats, such as forests, may inhibit spread of the disease by disrupting continuity of the population and reducing inter-individual contacts (Podgórski et al. 2020, Pepin et al. 2020). The locations of ASF-positive carcass can be used to create habitat maps determining the probability of finding contaminated carcasses. Such maps can be generated on the basis of the actual locations of at least 75 dead wild boar using the predictive model developed during our research (Morelle et al. 2019). This is a valuable tool in planning carcass search activity. It has been applied in Belgium and proven to increase search effectiveness.

6) The results of simulations testing the effectiveness of ASF control measures in wild boar populations (Taylor et al. 2020) have indicated that a reduction of population numbers by 50-75% limits the number of new cases, but is associated with a risk of spreading the disease to new areas. On the other hand, fencing ASF-infected areas within a radius of at least 20 km with a fence with high (95%) efficiency in blocking wild boar movements significantly reduces the spread of the disease to new areas. A combination of actions in the zoned system with a prohibition of hunting in the fenced infected zone, systematic search and removal of carcasses from the infected zone, and reduction of population size in the adjacent buffer area, is currently the most effective strategy for ASF control in wild boar, and has been successfully applied in the Czech Republic and Belgium (EFSA 2020).

Carcasses of infected wild boar are an ASF reservoir. Systematic carcass search and removal is a major tool in ASF control. (photo by Tomasz Kamiński)

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