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ASF EXPERT SERIES:
HOW TO COMBAT THIS LONG BATTLE AND SUCCEED

SWINE

THE UNSTOPPABLE SPREAD OF THE ASF VIRUS, ALREADY IN THE FIVE CONTINENTS

With ASF still a threat to pig industries, APC organized the ASF Expert Series webinar to share the global status of ASF and explore some of the strategies to mitigate its impact. In the series' third installment, Prof. José Sánchez-Vizcaino DVM, Ph.D, DhC, Director of the OIE-ASF Reference Laboratory, talked about the current situation of ASF in the five continents, tools available to control the spread and protect the farms and ASF vaccine development status.

Prof. José Sánchez-Vizcaíno
DVM, Ph.D, DhC.
Director of the OIE ASF Reference Laboratory

Review: the global situation of ASF

Since 2007 to date, ASF is currently affecting 5 continents, 50+ countries, represents >78% of world pig population and is likely to be underestimated due to limited surveillance and knowledge about ASF. In Africa, ASF was first reported in Kenya in 1921. Currently, 24 genotypes have been identified. Vectors (wild pigs) and reservoirs (soft ticks of the Ornithodoros spp.) are involved in the continuous cycle of hosting and amplifying ASFV and infect wild and domestic swine. In Europe (EU), ASF was first reported in Georgia in 2007. In eastern EU, ASF is more dominant in domestic pigs, while in western EU, more wild boars are infected with ASF. Data summarized from 2014 to June 2021 showed 10 of 27 EU countries were affected with ASF representing >5,300 farms and >39,000 ASF notifications in wild boars, which accounted for 12.1% and 87.9% of the total population, respectively. For wild boars, up to 64% of ASF cases are in natural reservation areas. The problematic remaining 32.4% of ASF cases are in Agroforestry and Agro-Urban areas where contact between wild boars and domestic pigs happens. In Asia Pacific (AP), ASF was first reported in China in 2018. Currently 16 of 28 countries in AP have been infected. Despite the higher density of wild boar populations in AP compared to EU, ASF cases are dominant in domestic pigs, rather than in wild boars. This could be due to a lack of monitoring or reporting cases of affected wild boars. Close monitoring is required to prevent a major outbreak cased by wild boars, as seen in EU.

Risk factors for ASFV transmission and transmission routes

In China, swill feeding in backyard/family farms is one of the main risk factors. Traditionally, untreated animal blood is mixed with feed and fed to pigs (one drop of blood from infected animal can contain $3x10^6$ copies of virus). In addition, low biosecurity, infected pigs or contaminated carriers to the slaughterhouse, unidentified/infected vehicles for transportation, no or poor compensation scheme, re-circulation of attenuated strain, and high population of wild boars in the area are important risk factors to consider.

Direct ASFV transmission route happens between infected and healthy domestic pigs in the farms and/or with wild boars in the natural habitat and Agroforestry and Agro-Urban areas. Soft ticks remain the most important biological vector, but only affect the local spread in outdoor production. Indirectly, ASFV is transmitted by contaminated meat products, feces, clothes/work boots/farm-use equipment, and mode of transportation (truck and plane). Although ASF is not as efficient by aerosol transmission compared to FMD, PRRS, or Classic Swine Fever, it is highly stable in nature and ASFV can be spread by the factors mentioned above. Transmission by blood in contaminated meat, hemorrhages, lesions, performing necropsy, hunting, and by flies are other routes. ASFV is highly resistant especially when organic matter is present. It can survive up to 1 month in contaminated pig pens, 18 months in blood at 4°C,

110 days in chilled meat at 4°C, and 1,000 days in frozen meat at -20°C. Double-fencing is needed in areas where wild boars are present. The area near backyard farms with swill feeding (from rest areas, ports, and tourist areas) should be closely monitored or avoided as well. Transport vehicles for animal, feed, and human laborers must be cleaned and disinfected properly.

Clinical signs of ASF and the importance of good and specific surveillance and contingency program

Typical clinical signs of acute and sub-acute ASF forms are fever, anorexia, hemorrhagic skin, diarrhea, and digestive problems. Symptoms and lesions vary from acute to asymptomatic. Commonly found necropsy results are enlarged spleen (splenomegaly), hemorrhage of the lymph node, skin, and intestines, kidney petechiae, pneumonia and hydrothorax in the lung, enlarged liver (hepatomegaly), and heart hydropericardium. In the chronic form, some skin lesions and inflammation can be detected, however the infected pigs appear normal, without fever, and therefore more difficult to detect. Samples of blood, serum, lymph node, spleen, lung, kidney, oral fluid, and feces can be collected for diagnosis of ASFV. Samples can be safely transported with a sponge saturated with an alcohol mixture. The alcohol inactivates the virus but does not affect the DNA of ASFV. The sample can be analyzed for ASF genome by RT-PCR. An antibody (Ab) test can also be done to identify the epidemiological scenario of the disease, where at the beginning of the infection (less than 12 days), the PCR test is positive, but the Ab test is negative or positive (PCR +++ and Ab +++). In many cases, late detection is caused by using an inadequate surveillance program, failure to distinguish clinical signs or lesions, lack of good or incomplete lab diagnosis, having low biosecurity (could be related to backyard and swill feeding), and lack of adequate and timely compensation to farmers which leads to an attempt to sell infected animals. In conclusion, a good and specific surveillance and contingency program in each country (adapted to all the different epidemiological scenarios) and a continuous education and training for veterinarians and farmers to know about ASF is required. More importantly, both public and private segments must collaborate.

The progress and current situation of ASF vaccine

Several prototypes of ASF vaccine are being evaluated around the world, but none are commercially available. More animal trials are needed to confirm its safety, efficacy, and cross protection. Based on the studies by Dr. Sánchez-Vizcaíno, an attenuated vaccine can induce immune protection up to 92 to 100% in domestic pigs and wild boars; however, the key is the balance between safety and efficacy of attenuated vaccine. The VACDIVA project has been approved by an EU committee for the development of the first oral ASF vaccine for domestic pigs and wild boars. This project is well collaborated by specialists from 13 EU and 3 non-EU partners. MSD and Innasa are commercial partners who will produce these vaccines and test kits in the future. Currently, 3 candidate vaccinees are being evaluated with a promising high level of protection (95 to 100%). Pilot vaccination programs in Lithuania (wild boars), Kenya (warthogs and bush pigs), and other countries (domestic pigs) are in preparation. Several studies to determine optimal dosage, immunization, and overdose immunization in domestic pigs and wild boars have been completed. On-going studies include genetic stability in vivo, adaptation of the vaccine prototypes to tissue culture, duration of immunity, large-scale immunization trials with domestic pigs, DIVA adaptation, bait conservation under different scenarios, and cross protection in wild boars and domestic pigs. Dr. Sánchez-Vizcaíno estimated that it could take another 1 to 2 years until final approval and completion of registration. Progress updates will be shared once available.

PLASMA BIOSAFETY & EFFICIENT PIG PRODUCTION

Dr. Javier Polo
Senior Vice President - Research & Development
APC

Dr. Javier Polo, APC's Senior Vice President - Research and Development, discussed Plasma biosafety and efficient pig production. Dr. Javier explained that APC applies the concept of Multiple Hurdle Mitigation Technology, which is commonly applied in food production. The concept involves applying multiple, low-level mitigation steps in sequence, which results in a more effective way to reduce and eliminate pathogens than the sum of each individual step. Firstly, Spray Dried Plasma (SDP) is manufactured from raw blood collected from only healthy animals that are fit for slaughter for human consumption. Secondly, Plasma flows through APC's exclusive UV-C photo-purification system which can eliminate bacteria and both enveloped or non-enveloped viruses. Thirdly, the spray-drying process dries the plasma at a minimum of 80°C throughout substance, which is a well-recognized inactivation step for viruses, including ASFV. Lastly, post-drying storage of packaged material at 20°C for 14 days ensures thorough inactivation of ASFV, if any were to re-contaminate the Spray Dried Porcine Plasma (SDPP) product (Fischer et al., 2021). In general, the total log reduction of viruses (both enveloped and non-enveloped) from the multiple hurdle steps used to manufacture SDPP is higher than 10 log. Specifically for ASF virus, UV-C, spray-drying, and post drying storage (20°C for 14 days) achieved 4.6, 4.1, and 5.1 log reduction, respectively, with a total of 13.8 viral log reduction. In comparison to OIE & EPA recognized disinfectants, a 4-log reduction equates to 99.99% effectiveness for inactivating viruses. A risk analysis of feed ingredients for transmission of ASFV conducted by European Food Safety Agency (EFSA) in 2021 demonstrated that hydrolyzed proteins and blood products ranked as the lowest risk, regardless of origin or destination due to multiple hurdle manufacturing process that ensures inactivation of potential viral contaminants. SDPP is a very safe ingredient for animal feed.

Beyond its nutritional value, SDP contains a functional protein profile like colostrum and sow milk, which includes Transferrin (to bind iron), Lysozyme (to attack bacteria), Growth factors (to repair stem cell), Cytokines (inflammatory response), and IgG (to bind toxins and pathogens). Under stressful or pathogen-challenged conditions, SDP-fed pigs have a more efficient immune system response which conserves more energy and nutrient use for growth.

A review of published scientific studies in 2001 concluded that SDP in creep/pre-starter feed provided through at least 2 weeks post weaning improved average daily gain (ADG) by 31%, average daily feed intake (ADFI) by 25%, and feed efficiency (FCR) by 4% on average. A meta-analysis (Balan et al., 2020) from 135 publications showed an incremental improvement in ADG (+36 g/d) and ADFI (+38 g/d) in the first 40 days post weaning for pigs fed diets with SDP compared to a control group fed with other alternative proteins. A study conducted in USA (Peace et al., 2011) with pigs fed diets with 0%, 2.5%, or 5% SDP for 14 days after weaning concluded that 5% SDP significantly improved diarrhea score, reduced pro-inflammatory cytokines in intestinal tissue, and restored gut barrier function, compared to pigs fed diets with 0% or 2.5% SDP. Studies in multiple species with both enteric and respiratory challenges concluded that SDP improved fecal score, ADG, survival rate, and feed efficiency. A large epidemiological study in Canada (Dewey et al., 2006) assessed the impact of different biosecurity factors including farm biosecurity, disease status, farm management, and nursery nutrition in commercial nurseries. Results showed that the inclusion of plasma in the first and second nursery diets was more highly associated with higher survivability than weaning weight. The Danish Feed Research Centre (SEGES) recently published a recommendation of 5% SDP inclusion in diets for weaned pigs <7 kg body weight to replace high dietary levels of ZnO used to control post-weaning diarrhea.

Regardless of origin, bovine or porcine plasma provides an equal growth advantage over a non-plasma diet. (Crenshaw et al., 2015) showed a significant BW improvement (+750 grams) at 35 days of age for both 6% bovine and porcine SDP-fed groups. In a PEDV challenge study (Duffy et al., 2018), pigs fed a diet with bovine SDP had an earlier antibody response with a more rapid clearance of PEDV found in feces.

In summary, the multiple hurdle biosafety steps used in the SDPP manufacturing process produces a very safe feed ingredient for animal diets. SDPP has functional protein components that help pigs to overcome stressful events such as weaning and periods of disease challenge. APC manufactures and provides 100% Porcine or 100% Bovine Spray Dried Plasma products for use in the feed.

For more information, contact the APC Technical Service team or visit our website