SHIC
Swine Health Information Center

Newsletter
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OUR LATEST INFORMATION ON PROTECTION OF US SWINE HERD HEALTH

SHIC Funds Porcine Sapelovirus Genetic Characterization and Diagnostic Tool Development

The Swine Health Information Center (SHIC) maintains a priority on diagnostics of swine diseases as part of its mission to protect and enhance the health of the US swine herd. Consequently, SHIC funded a project for genetic characterization and diagnostic tool development for an emerging porcine sapelovirus (PSV). This emerging virus was isolated in a diagnostic specimen from a US swine farm and designated as PSV KS18-01. In work done at Kansas State University and the University of Illinois, a full-length genome sequence was obtained through next-generation sequencing. Phylogenetic analysis showed that the virus is more closely related to two Japanese strains but is distantly related to two known US strains. PSV specific diagnostic tools were developed, including the monoclonal antibodies again VP1 and VP2, and a VP1-VP2 antigen-based indirect ELISA. Using this assay, the dynamic response of PSV antibody was investigated in a group of post-weaned pigs that were naturally exposed with PSV. The availability of the PSV isolate (KS18-01) and the specific diagnostic reagents and assays provide important tools for PSV control and prevention.

Porcine Sapelovirus (PSV), previously named as porcine enterovirus 8, belongs to the genus Sapelovirus in the family Picornaviridae. PSV is a non-enveloped, positive-sense single-stranded RNA virus. PSV infection is commonly asymptomatic, but clinical disease of respiratory failure, diarrhea, reproductive disorder, and polioencephlamyelitis have been reported in swine farms from many countries.

Additional pathogenesis studies are required for in depth characterization of different PSV strains, especially the newly emerging strains. The virus isolate, diagnostic reagents and assays generated in this study will be important tools in aid of future pathogenesis studies as well as development of vaccines and therapeutics against PSV infection.

SHIC-Funded Study Evaluated Soy Importation Data

Soy-based products, including components of swine diets, can harbor and transmit viruses. The related viable risk to US swine herds prompted a Swine Health Information Center-funded project designed to evaluate US soy imports as a whole. This includes imports from foreign animal disease positive (FAD-positive) countries. The goal of the research, led by Allison Blomme, Dr. Chad Paulk, and the Feed Safety Team at Kansas State University, was to determine which products are being imported in the highest quantities and observe potential trends in imports from FAD-positive countries. Understanding

the sources and intended uses of products being imported to the US is vital to determining the risk of FAD disease introduction.

Import data for the study were accessed through the United States International Trade Commission website (USITC DataWeb) and summarized using R (version 4.0.2, R core team, Vienna, Austria). Quantities of imports were determined, with a breakdown of different soy product types being imported into the US from 2015 to 2020. A total of 78 different countries exported soy products to the US in 2019 and 2020 with top contributors being Canada, India, and Argentina. Soy oilcake was imported in the largest quantities, followed by organic soybeans and soy oil for 2020. Of the 78 countries, 46 had cases of FAD reported through the World Organization for Animal Health (OIE) World Animal Health Information Database (WAHIS).

Top exporters of soy products to the US from FAD-positive countries in 2019 and 2020 were India, Argentina, and Ukraine. The risk of FAD introduction to the US through soy imports can fluctuate based on where FAD outbreaks are occurring, shipping methods, and end usage of products. A system to monitor these factors could help make future decisions about trade and risk of FAD introduction to US swine herds. The complete paper can be found at https://onlinelibrary.wiley.com/doi/full/10.1111/tbed.14284

Based on the information generated from this project, the authors also offered their responses to what they consider to be frequently asked questions concerning international shipping of soy and their recommendations of best practices for importation of soy products.

In what form is soy shipped into the US?

Imported soy products with the intent to be used in feed are primarily shipped into the US as oilcake, organic soybeans, or soy oil. These products were determined using the Harmonized Tariff System codes in the US International Trade Commission database. The shipper declares these codes and, therefore, may have some variation of the actual product (ex: the byproduct of oil extraction may be declared as oilcake or soy flour and meal). This declaration depends on the properties of the product as well as tariffs on particular product types.

What are the most common ports of origin/loading of oilcake, organic soybeans, or soy oil?

This information is not clearly defined. Shipping information can be found for shipments by HTS code, but they must be collected one by one. For example, only two shipments of organic soybeans in 2020 were identified and were loaded in Jawaharlal Nehru, India. However, it is important to consider both the country of origin for a product and the country of loading because one may be FAD-free while the other is positive. It is not uncommon for soy products to be shipped overland until reaching a port to be loaded for transport overseas (ex: soybean meal from Romania may be transported to Antwerp, Belgium before being loaded onto a ship)

What processes or procedures are common or feasible in ports of origin or countries in order to reduce the risk of contamination?

This information is not entirely clear. Depending on the port's capacity to ship containers vs. dry-bulk, holding may be implemented. Other forms of mitigation are an option; however, their regulatory approval and practical applications in ports are limited. Mitigation measures, whether holding or other, would likely require some form of phytosanitary certification to determine compliance. This would add an extra level of documentation and regulation. Ultimately, implementing risk-reduction measures in the US would be the most reliable.

What are the most common ports of entry for soy into the US?

Most soy products enter through Michigan, New York, Maryland, California, or New Orleans. Organic soybeans were most commonly imported through New Orleans in 2020. An important factor to consider is the number of shipments into a port vs the quantity of product. Many ports have a large number of shipments, but these shipments may be small quantities, like bags. Other ports, like New Orleans, receive relatively few shipments, but these shipments are larger and consist of containers or dry-bulk product.

How long is transport from port of loading to port of entry?

There are several influential factors that influence transportation time. The largest is whether the ingredient is being shipped via container or dry-bulk. Container shipping vessels travel from port to port, loading and unloading containers as appropriate (similar to a city bus route). Dry-bulk shipping is a direct route from loading to destination due to the fact that an entire vessel is hired for one large shipment. Beyond this, the cost of freight and the cost of fuel dictate the speed at which these vessels are traveling because they are more fuel efficient at lower speeds.

Where does the majority of this product go upon arrival to the US?

This is not well understood. Brokers are commonly used for the importation of ingredients which are then distributed once the products arrive in the country. Shipping of products from the port into the interior is proprietary information between customers and the rail and barge companies. The end use of these products could be speculated based on HTS codes, but it is unclear if products like soy oilcake stay in the US or are shipped to other countries from US ports. Other products such as whole soybeans can be used for human consumption or can be pressed to extract the oil. This crushing leaves soybean meal that can be used for livestock feed. This versatility makes tracking these products even more complex.

Is soy being shipped via dry-bulk or through containers?

Ports in the US are designed to ship agricultural commodities out. Arrival of dry-bulk commodities can be handled, but they typically need to be unloaded straight into a railcar, barge, other vessel, or into a private warehouse. Container shipping is more common, due to the fact that dry-bulk shipping requires an entire vessel to be contracted by a company or a group of companies for a very large shipment.

What challenges do US ports face concerning the import of contaminated soy?

Ports in the US were designed to export agricultural commodities and less emphasis was placed on import. As a result, US ports do not have the capacity to hold grains once they enter the country. If holding times are used to mitigate contamination, it is up to the importer or the end user to facilitate that and provide space for the grains to be held.

Best Practices for Importation of Soy Products

What areas are important to understand when evaluating the use of imported soy?

Understanding where foreign animal disease (FAD) outbreaks are occurring around the world, where the soy products used for animal production originated, and where those products were loaded to be shipped to the US (if applicable) are all important for reducing risk of introducing FAD to US herds via feed. Not all of these areas would be handled by the same set of people in a production system, so collaboration between departments is vital.

Who should be part of discussions involving the use of imported soy?

Facilitating discussions across supply chain managers; between nutritionists, biosecurity leads, procurement teams, and ingredient suppliers is the first step to understanding if any feed products used in the production system are imported.

If soy is imported, what steps should be taken to reduce risk?

The country of origin should be verified for imported ingredients and referenced against countries experiencing known FAD outbreaks. If products are being imported, finding an alternative, domestic ingredient or implementing holding times prior to introduction to a mill will strengthen a biosecurity plan.

When should holding times be in effect?

If holding times are implemented, it is good practice to start the clock, at the earliest, when the product has entered the US. At this point, the processes the product goes through can be more reliably documented and the risk of cross- contamination is reduced. Importers have the opportunity to ensure that potentially contaminated product does not share equipment with products that have completed a holding period, been processed, or were domestically produced.

Is product loaded in a FAD-free country safe?

Even though a product was loaded in a FAD-free country, it may have been produced in a country experiencing an outbreak and then subsequently shipped overland to a port. As a result, the country or origin and the country of loading should be evaluated as well. If a product is undergoing further processing once it enters the US, it may have a lower risk to domestic livestock. Processes like solvent extraction or extruding have the potential to eliminate infectious virus from the feed product, when done properly.

More SHIC-Funded Vietnam ASF Research Results Reported

A 2019 grant from USDA's Foreign Agricultural Service division, awarded to the Swine Health Information Center (SHIC) who applied with National Pork Producers Council assistance, funded multi-phase African swine fever (ASF) field projects in Vietnam. One completed study evaluated the performance of ASF serum and/or oral fluid ELISAs for use in the surveillance and monitoring of ASF outbreaks in commercial farms in Vietnam and in preparation for the virus becoming endemic in the US. This study shows there is no single best diagnostic approach for ASFV surveillance and demonstrates that the combined use of the Tetracore qPCR and indirect ELISA tests and serum/oral fluid sampling increase efficiency of ASF disease surveillance. Another completed study modeled the risk of introducing ASF to a sow farm as a result of semen movement from apparently healthy boar studs located in an ASF disease control area. Results indicated the risk is negligible to low given study parameters, however, several factors with the potential to impact these results were acknowledged.

The study, "Evaluation of the diagnostic performance of an ASFV serum/oral fluid antibody ELISAs under field conditions in Vietnam," evaluated performance of these tests for surveillance and monitoring of outbreaks on commercial farms. A collaborative project between Innoceleris LLC and Tetracore Inc., the work addresses the complicated interpretation of ASF diagnostic results. A field team from Hanoi University collected 398 paired serum/oral fluid samples from individual animals, including 100 samples from 34 ASF-acute farms, 98 samples from 47 ASF-chronic farms, and 200 samples from 20 ASF-negative farms.

The samples were tested by Tetracore ASFV iELISA and real-time PCR (qPCR). As expected, the detection rate by qPCR (74% serum; 69% oral fluid) was higher than by ELISA (16% serum; 11% oral fluid) in acute farms since most of the animals did not yet seroconvert. In contrast, in chronically affected farms, the detection rate of the ELISA was higher (72% serum; 57% oral fluid) than the qPCR (56% serum; 34% oral fluid). However, when researchers combined both qPCR and ELISA, the detection rate of ASFV positive animal increased in acute (75% serum; 74% oral fluid) and particularly in chronic farms (85% serum; 74% oral fluid). All serum samples from negative farms were negative by both ELISA and qPCR (100% diagnostic specificity) while, for oral fluids, researchers obtained 100% and 99% diagnostic specificity for qPCR and ELISA, respectively. The high diagnostic specificity of the tests is particularly important for ASF surveillance. Absence of false positives avoids false alarms and disruption in production, and lack of confidence in the tests/surveillance system.

The study, "Determining the pathways for ASF introduction into boar studs and risk of ASF transmission via semen movements during an ASF outbreak," included a proactive risk assessment (RA) that looked at the potential risk of semen movements during an outbreak. Researchers, led by staff at the University of Minnesota, established the ASF Boar Semen RA workgroup (WG). Together with researchers at the University of Hanoi, experts determined 10 potential entry pathways for ASF into boar studs as people, feed, water, geographic and/or aerosol transmission, fomites (such as tools, equipment, vehicles), mortality management, domestic animals (such as dogs, cats, replacement boars), biological materials (such as medicines and vaccines), insects/ticks, and wildlife. They further evaluated these pathways on this scale: Extremely High, High, Moderate, Low, Negligible.

Data from a boar stud in Vietnam were also obtained by working with a Vietnamese collaborator who was able to visit the site and perform an epidemiological investigation that included premises description, farm biosecurity, farm help/workers, farm equipment, manure handling, dead pig disposal, farm visitors,

presence of wild animals, mortality data, description of the recent biosecurity practices, and a farm diagram. Of most value were data regarding clinical signs and diagnostic tests.

As a result of the pathway analyses, the proposed estimated likelihood of ASFV infection of a boar stud operation in a Control Area due to water was negligible, as long as no surface water is being utilized in the boar stud operation. The likelihood of ASFv introduction was negligible to low for feed, insects/arthropods, and wildlife (including infected feral pigs), as long as boar studs continue their standard biosecurity practices such as tandem feed bins, insect control, indoor housing, and double fencing.

The likelihood of ASFv introduction was low for people, fomites, domestic animals (including replacement boars), and biological materials, as long as boar studs continue requirements and procedures including but not limited to shower-in/shower-out people entry with downtime from other pigs, decontamination and disinfection for materials entering the stud, and housing of replacement boars in isolation barns away from the boar stud and lab.

It is very important to note for seven potential entry pathways of ASF infection (people, feed, fomites, animals, insects/arthropods, wildlife, and domestic animals), there are suggested Enhanced Biosecurity Recommendations (EBRs) in the Secure Pork Supply (SPS) plan that, if followed and done correctly, are critical to lowering the risk of ASF infection. Therefore, following all EBRs was assumed to occur when these ratings were made, and examples of these biosecurity practices have been given above (for example, shower-in/shower-out).

On top of the EBRs in the SPS plan, the WG proposed putting into place targeted EBRs to further reduce the risk of ASF infection. When the WG decided these targeted EBRs were feasible by the vast majority of boar studs in the US swine industry, these protective actions were included in the estimates of the likelihood ratings.

This proactive risk assessment will be reviewed and open for comments. The comments will be considered and use to update the risk assessment as necessary before and during an ASF outbreak in order to incorporate the latest scientific information and preventive measures. If the Incident Command System (ICS) is activated in response to an ASF outbreak, Incident Command staff will review the risk assessment to assess industry requests for movement of liquid, cooled boar semen from a boar stud in a control area.

In total, the ASF-related research taking place in Vietnam is designed to help Vietnamese response and recovery from the ASF epidemic and US pork producers learn lessons about ASF epidemiology and management, results continue to provide valuable insight.

SHIC-Funded MSHMP and NCSU Project Models PRRS Dissemination Dynamics

Just in time to prevent and prepare for seasonal PRRS outbreaks, a team led by North Carolina State University researchers and funded by the Fats and Proteins Research Foundation, along with the University of Minnesota Morrison Swine Health Monitoring Project (MSHMP), funded by the Swine Health Information Center (SHIC), developed and calibrated a mathematical model for transmission of porcine reproductive and respiratory syndrome virus (PRRSV). Their recently published work demonstrated the contribution of multiple unmeasured routes of PRRSV dissemination, including for the first time the role of animal by-products delivered via feed meals, and multiple transportation vehicle networks. It also provides strong evidence to support the need for cautious, measured PRRSV control strategies for transportation vehicles and, to some degree, feed by-products. The project provides valuable information and opportunities for the swine industry to focus effort on the most relevant modes of PRRSV between-farm transmission.

Researchers examined nine modes of between-farm transmission pathways including:

- farm-to-farm proximity (local transmission)
- contact network of batches of pigs transferred between farms (pig movements)
- four different contact networks of transportation vehicles (vehicles to transport pigs to farms, pigs to markets, feed and crew)
- amount of animal by-products within feed

ingredients (e.g. fat and meat and bone)
- re-break probabilities for farms with previous PRRSV outbreaks.

Their model was calibrated on weekly PRRSV outbreak data managed by MSHMP. Researchers assessed the role of each transmission pathway considering the dynamics of specific types of production (i.e. sow farm, nursery). Results estimated that the networks formed by transportation vehicles were more densely connected than the network of pigs transported between farms. The model also estimated that pig movements and farm proximity were the main PRRSV transmission routes regardless of farm types, but vehicles transporting pigs to farms explained a large proportion of infections:

- sow = 20.9%
- nursery = 15%
- finisher = 20.6%

Vehicles transporting feed represented the highest risk for PRRSV propagation in comparison with other vehicle networks, connecting around 85% of farms. Animal by-products showed a limited association with PRRSV outbreaks through descriptive analysis, while model results showed the contribution of fat and meat and bone was 2.5% and 0.03%, respectively, of the infected sow farms.

Ultimately, this study provides a better understanding of the role of several transmission routes for PRRSV dissemination and can provide bases to the swine industry to evaluate and strengthen the surveillance of transportation vehicles and feed delivery to better contain the propagation of PRRSV.

SHIC Shares Swine Health Information with Farm Broadcasters

Information is part of the Swine Health Information Center's (SHIC's) name. The mission is protecting and enhancing the health of the US swine herd and SHIC accomplishes this goal through coordinated global disease monitoring, targeted research investments that minimize the impact of future disease threats, and analysis of swine health data. Then SHIC shares their information frequently, broadly, and across many platforms.

During the recent National Association of Farm Broadcaster's Annual Meeting and Trade Talk, SHIC Executive Director Dr. Paul Sundberg was present and gave more than a dozen interviews to farm broadcasters. In addition to those in these photos, he also spoke with Rodney Bain of USDA Radio and Meghan Dehn, KMZU Radio, Carrollton, Missouri.

These interviews help SHIC share its information, a valuable resource for pork producers, swine veterinarians, industry, and partners. As a result of these interviews, SHIC information was shared on three national networks, five regional networks covering 20 states, and eight radio stations covering five states.

While Trade Talk is an intense day of interviews and sharing, SHIC regularly shares information via media interviews as well as other tools. SHIC's website is regularly updated with emerging disease information, research results, articles prepared for partners, and more. SHIC's newsletter goes out monthly to a large group of stakeholders; click here to subscribe. Quarterly webinars with co-sponsor the American Association of Swine Veterinarians cover timely topics in swine health. SHIC Talk, the Center's podcast, will be back in 2022. SHIC is also active on Facebook, Twitter, and LinkedIn.

SHIC offers its thanks for media who help share swine health information, providing access to the important work done by the Center for the benefit of the US swine industry.

Andy Petersen (l) and Bob Quinn (r) of The Big Show on WHO Radio, Des Moines, interview Dr. Sundberg during NAFB Trade Talk 2021

Influenza Management Strategies Webinar

Tuesday, December 14, 2021
1:00 - 2:30 pm CDT

The Swine Health Information Center (SHIC) and American Association of Swine Veterinarians (AASV) will host a webinar on swine influenza management strategies. Presenters Dr. Phil Gauger, Iowa State University, and Dr. Amy Vincent, USDA-ARS National Animal Disease Center, are experts in swine influenza and related research. Dr. Dyneah Classen, Carthage Veterinary Service, is a practitioner with hands-on swine influenza experience.

Presenters

- Dr. Phil Gauger, Iowa State University
- Dr. Amy Vincent, USDA-ARS National Animal Disease Center
- Dr. Dyneah Classen, Carthage Veterinary Service

To register: https://iastate.zoom.us/webinar/register/WN_RgvdKWQTRKOLpyVKDg0L4A

SHIC/AASV sponsored webinars bring together subject matter experts to discuss current issues facing US pork producers and practitioners. Conducted by the Iowa State University Swine Medicine Education Center (SMEC), webinar participants include practitioners with first-hand experience with the topic being discussed, diagnosticians, and other experts. Completed webinars are posted online for convenient access here.

Do you have a recommendation for a topic to be addressed in this format? SHIC and AASV would like your input! Reach out to SHIC Executive Director Dr. Paul Sundberg at psundberg@swinehealth.org or AASV Director of Public Health and Communications Dr. Abbey Canon at canon@aasv.org with your webinar recommendations.

SHIC, launched by the National Pork Board in 2015 solely with Pork Checkoff funding, continues to focus efforts on prevention, preparedness, and response to novel and emerging swine disease for the benefit of US swine health. As a conduit of information and research, SHIC encourages sharing of its publications and research. Forward, reprint, and quote SHIC material freely. SHIC is funded by America's pork producers to fulfill its mission to protect and enhance the health of the US swine herd. For more information, visit http://www.swinehealth.org or contact Dr. Sundberg at psundberg@swinehealth.org.

SWINE DISEASE MONITORING REPORTS

As the world deals with the COVID-19 pandemic, SHIC continues to focus efforts on prevention, preparedness, and response to novel and emerging swine disease for the benefit of US swine health.

DOMESTIC

This month's Domestic Swine Disease Monitoring Report shows a moderate increase in detection of porcine reproductive and respiratory syndrome virus (PRRSV) in breeding herds occurred in November. This finding agrees with past reports that have highlighted spikes in grow-finish pigs (seen since September) usually are followed by increased activity in breeding herds. Detection of enteric coronaviruses, i.e., porcine epidemic diarrhea virus (PEDV), porcine delta coronavirus (PDCoV), transmissible gastroenteritis (TGE), and M. hyopneumoniae, by PCR are at expected levels for this time of the year. In the podcast, SDRS hosts talk with Dr. Peter Schneider, field veterinarian at Innovative Agriculture Solutions, LLC, about his experience on animal health management, disease management, control, and his advice to the swine industry to better handle animal health interventions.

VIEW REPORT

GLOBAL

In this Global Swine Disease Monitoring Report, read about African swine fever (ASF) in Eastern Europe, Germany, Vietnam, and beyond. In Eastern Europe, 27% more cases of ASF have been reported than the same time frame in 2020. A third state in Germany has also been affected by ASF. Continued spread in Vietnam has developed fears of a possible local pork shortage due to a new wave of the disease.

VIEW REPORT