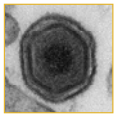
Slide 1	African Swine Fever *Pesti Porcine Africaine,* *Peste Porcina Africana,* *Maladie de Montgomery*	African swine fever is a highly contagious, viral disease of pigs. The disease can have serious animal health and economic consequences. African swine fever is an OIE-notifiable disease and can result in international trade impacts. African swine fever is also known as pesti porcine Africaine, peste porcina Africana, or maladie de Montgomery.
Slide 2	Overview • Organism • Economic Impact • Epidemiology • Transmission • Clinical Signs/Necropsy • Diagnosis • Prevention and Control • Actions to Take 	This presentation will provide an overview of African swine fever – the organism responsible for the disease and its epidemiology. It will discuss how the disease is transmitted or spread, the species it affects, clinical signs that may be seen, and necropsy findings. Information on the diagnosis of the disease is covered. Lastly, prevention and control measures for the disease and actions to take if African swine fever is suspected are provided. [Photo source: Dr. Alex Ramirez, Iowa State University, College of Veterinary Medicine]
Slide 3	Species Affected • Domestic pigs • Feral swine • Wild pigs – Eurasian wild boars – Warthogs (reservoir) – Bush pigs (reservoir) – Giant forest hogs 	African swine fever, as its name suggest, affects members of the pig family, Suidae. Species that can be infected include domesticated swine, Eurasian wild boars, warthogs, bush pigs, and giant forest hogs. Feral swine are also susceptible. Warthogs and bush pigs are generally asymptomatic and are thought to be wildlife reservoirs for the virus in Africa. Peccaries were once considered to have asymptomatic infections; however, more recent reviews state that that peccaries are not susceptible. (Note: in the U.S. feral swine are defined by USDA as a combination of escaped domestic pigs, Eurasian wild boars, or hybrids of the two). [Photos: Top: Central European boar (*Sus scrofa*) (Source: By Valentin Panzirsch - File:Wildschein, Nähe Pulverstampftor.jpg, CC BY-SA 3.0 at, https://commons.wikimedia.org/w/index.php?curid=46902117) Middle: Warthog (*Phacochoerus africanus*) (Source: George Mason University-mason.gmu.edu); Bottom: Bush pig (*Potamochoerus larvatus*) (Source: http://www.rth.org/sdzoo/Western%20bush%20pig.jpg)]
Slide 4	**THE ORGANISM**	

Slide 5

African Swine Fever Virus

- Asfarviridae: *Asfivirus*
  - Large, enveloped DNA virus
  - Only arbo-DNA virus
- More than 20 genotypes
  - Vary in virulence
  - High virulence: up to 100% mortality
  - Low virulence: seroconversion
- Infects monocytes and macrophages



African swine fever (ASF) is caused by the African swine fever virus (ASFV), a large, enveloped DNA virus. This virus is unique as it is the sole member of the genus *Asfivirus* (family Asfarviridae), and is the only known arthropod-borne DNA virus. More than 20 genotypes of ASFV have been identified. ASFV isolates vary greatly in their virulence, with highly virulent isolates causing up to 100% mortality, while lower virulent isolates may lead only to seroconversion. All genotypes are present in Africa, while genotypes I and II have been found outside of Africa. The ASFV primarily infects cells of the mononuclear phagocytic system – monocytes and macrophages. The virus also has a predilection for lymph nodes near the head.

[Photo: Transmission electron microscopy (TEM) electromicrograph of the African swine fever virus. Source: Institute for Animal Health. Creative Commons Attribution-ShareAlike. https://en.wikipedia.org/wiki/File:African_swine_fever_virus_virion_TEM.jpg]

Slide 6

African Swine Fever Virus

- Highly resistant in environment, especially at lower temperatures
- Survival
  - Several days in feces
  - Month(s) in contaminated pens
  - Up to 18 months in blood
  - Over 140 days in some pork products
    - Salted dried hams
  - Years in frozen carcasses

ASFV is highly resistant in the environment, especially at lower temperatures, and in proteinaceous environments (e.g., uncooked pork meat products). The virus can remain viable for long periods in blood, feces and tissues. It can survive for several days in feces at room temperature, at least a month in contaminated pig pens, and up to 1 ½ years in blood stored at 4°C (39°F). The virus will also remain infectious for 150 days in boned meat stored at 3.9°C (39°F), 140 days in salted dried hams, and several years in frozen carcasses.

Slide 7

Virus Inactivation

- Most disinfectants ineffective
- Disinfectants on nonporous surfaces
  - Sodium hypochlorite, citric acid, some iodine and quaternary ammonium solutions
- Meat/tissue products
  - High temp (70°C/150°F) for 30 min
- Can be inactivated
  - pH below 3.9 or above 11.5
  - Higher pH needed if serum present

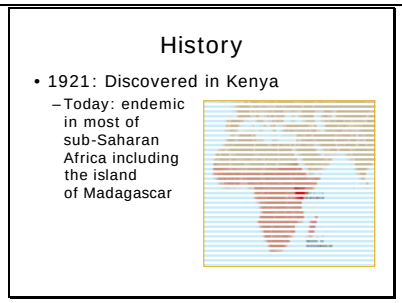
Many common disinfectants are ineffective against African swine fever virus. Care should be taken to use a disinfectant specifically approved for the virus. Serum and feces has been found to greatly inhibit the efficacy of disinfectants, so thorough cleaning prior to disinfectant application is important. Sodium hypochlorite, citric acid and some iodine and quaternary ammonium compounds are reported to destroy ASFV on nonporous surfaces. Unprocessed meat must be heated to at least 70°C (150°F) for 30 minutes to inactivate ASFV. Virus can also be inactivated by pH <3.9 or >11.5 on clean surfaces; however in the presence of serum the resistance of the virus increases, requiring up to pH 13.4 for inactivation. (OIE)

Slide 8

HISTORY AND IMPORTANCE

African swine fever has historically caused substantial animal health and economic impacts, and is a continued concern.

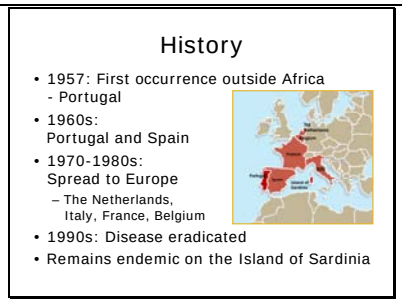
Slide 9



ASFV was first discovered in domesticated swine in Montgomery, Kenya in 1921. Today the disease is considered endemic in most of sub-Saharan Africa, including the island of Madagascar.

[Graphic: Map of Africa with Sub-Saharan region shaded and Kenya and the Island of Madagascar highlighted. Map adapted with permission from Templates from yourfreetemplates.com.]

Slide 10



The first occurrence of ASF outside of Africa occurred in Portugal in 1957. The disease became endemic in Spain and Portugal in the 1960s and subsequently spread to other countries in Europe (i.e., the Netherlands, Italy, France, Belgium). Eradication efforts "stamped out" the disease in the 1990s – taking more than 30 years for complete eradication, with the exception of the island of Sardinia (Italy), where the virus is now considered endemic.

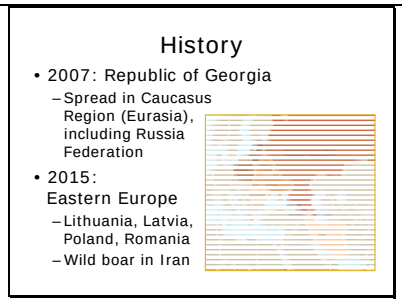
[Graphic: Map of Europe with Portugal, Spain, France, Belgium, Italy, and the Netherlands highlighted. Map adapted with permission from Templates from yourfreetemplates.com.]

Slide 11

Around that same time, in 1963, Spanish researchers isolated ASFV from the soft tick *Ornithodoros erraticus* collected from ASF-infected farms. [*Ornithodoros* is a genus in the soft-bodied tick family, Argasidae.] They found the virus replicates inside the ticks and the virus can be transferred through tick bites. Individual ticks can remain infected for life, and infected soft tick colonies maintain the virus for years. In 1971, ASF first appeared in the Western Hemisphere in Cuba. The disease was eradicated following the death or depopulation of over 400,000 pigs.) In the late 1970s, ASF outbreaks occurred in Brazil, the Dominican Republic, Haiti and again in Cuba. Severe epidemics occurred in Brazil (1978-1981) and Haiti (1978-1984. The disease has been successfully eradicated from the Western Hemisphere by depopulation measures.

[Photo: (Top) *Ornithodoros* tick (*Ornithodoros savignyi*) by Alan Walker from https://en.wikipedia.org/wiki/Ornithodoros#/media/File:Ornithodoros-savignyi.jpg is licensed under CC BY-SA 3.0; (Bottom) Map of Caribbean islands and Brazil adapted with permission from Templates from yourfreetemplates.com]

Slide 12



In 2007, ASFV was introduced into the Republic of Georgia in the Caucasus Region of Eurasia. From there it spread to neighboring countries of Armenia and Azerbaijan as well as the Russian Federation and Belarus. As of 2015, infections had been reported as far west as Lithuania, Latvia, and Poland. Viruses that apparently originated from this outbreak have also been found in wild boar in the Middle East (Iran). The source of the virus for this outbreak is unknown but is thought to have come from imported frozen or processed pig meat.

[Photo: Map of Eurasia adapted with permission from Templates from yourfreetemplates.com]

Slide 13

2018 Outbreaks

- China: First time reported, domestic pigs
- Belgium: Wild boars
- Hungary, Estonia, Latvia, Lithuania, Russia, Poland, Ukraine, Bulgaria, Romania

In August 2018, China reported their first African swine fever outbreak in domestic swine. As of September 25, 2018, 25 premises* had been confirmed and over 40,000 animals had been depopulated to control the outbreak. (Source: OIE and USDA). In September 2018, ASF was confirmed in Belgium in several wild boars that subsequently died. Other outbreaks reported in 2018 included Hungary, Estonia, Latvia, Lithuania, Russia, Poland, Ukraine, Bulgaria, and Romania.

[Photo: [Photo: Map of Eurasia adapted with permission from Templates from yourfreetemplates.com]

Slide 14

History: Virus Introduction for Outbreaks

- Uncooked/undercooked pork products fed to pigs (imported, illegal)
  - Portugal , Spain (1960); Italy (1983); Belgium (1985); Russia (2008); Romania, China (2018)
- Raw pork waste/garbage at airport or shipping ports
  - Lisbon (1957), Malta, Sardinia (1978), Georgia (2007)
- Movement of infected wild boars
  - Russia (2008)

The method of introduction of African swine fever for the previous outbreaks has been linked to several factors. Uncooked or undercooked pork products – both imported and illegal – that were fed to swine, raw pork waste or garbage from international airports or shipping ports subsequently fed to swine, and the movement of infected wild boars that contact domestic pigs.

[Source: https://www.slideshare.net/ILRI/asf-global-impact-and-control. Dr. Jose Sanchez-Vizcaino, www.sanidadanimal.info; OIE Reference Laboratory for ASF]

Slide 15

Economic Impact

- Animal health
  - High morbidity and mortality
  - Highly contagious
- Import and export bans
- Movement restrictions
- Quarantine and depopulation
  - Required for eradication
    - 1971-Cuba: 400,000 pigs
    - 2018-Romania: over 120,000 pigs
- Can become prolonged epidemic

The impact of African swine fever can have serious animal health, economic, and international trade consequences. ASF can have a high morbidity and mortality rate in infected swine. The disease is a threat to global food security. ASF is listed as a notifiable disease with the World Organization for Animal Health (OIE) as well as a U.S. Department of Agriculture (USDA) high consequence foreign animal disease. Confirmed cases may lead to a ban on the import and export of pigs and pork products to and from many different countries with significant negative economic impact. For successful eradication, quarantine and depopulation of affected herds will be required to stop the further spread of the virus. Past outbreaks have taken this approach, depopulating hundreds of thousands of swine in the eradication effort. Failure to quarantine and depopulate can contribute to a prolonged outbreak and epidemic.

Slide 16

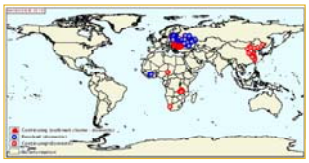
EPIDEMIOLOGY

Slide 17

Geographic Distribution

- Endemic
  - Sub-Saharan Africa
  - Island of Sardinia (feral swine)
- Continued outbreaks
  - Central and Eastern Europe
    - Poland, Czech Republic, Hungary, Romania, Ukraine
  - Eurasia: Russia, Caucasus
  - Belgium
- Never been reported in United States, Canada, Mexico, Australia, New Zealand

ASF is endemic in most of sub-Saharan Africa, including the island of Madagascar. The virus is considered endemic in feral swine on the island of Sardinia (Italy). Outbreaks continue to occur in several European countries and in the Caucasus Region (including Georgia, Armenia, and southwest Russia). This virus has also been detected in wild boar in Iran and in several Baltic countries. To date, ASF has never occurred in the United States, Canada, Australia, or New Zealand.

Slide 18	Reported Outbreaks OIE: Jan-Sept 2018 	This map shows the OIE-reported outbreaks (red) of African swine fever from January through September 26, 2018. [Photo: OIE World Animal Health Information Database. January 2018-September 25, 2018. https://www.oie.int/wahis_2/public/wahid.php/Diseaseinformation/Diseaseoutbreakmaps?disease_type_hidden=&disease_id_hidden=&selected_disease_name_hidden=&disease_type=0&disease_id_terrestrial=12&disease_id_aquatic=-999&speciesselect%5B%5D=17&selected_start_day=1&selected_start_month=1&selected_start_year=2018&selected_end_day=1&selected_end_month=10&selected_end_year=2018&submit2=OK]
Slide 19	Morbidity and Mortality • Morbidity up to 100% – Previously unexposed herds • Mortality varies with genotype virulence – Ranges from <5% to 100% • All ages affected • Subacute mortality = 30% to 70% • May be asymptomatic in wild pigs	In domesticated pigs, the morbidity rate can approach 100%. The mortality rate depends on the virulence of the isolate, and can range from <5% to 100%. Highly virulent isolates can cause nearly 100% mortality in pigs of all ages. Less virulent isolates are more likely to be fatal in pigs with a concurrent disease, pregnant animals and young animals. Mortality also tends to be high when ASFV is introduced into new regions, with an increased incidence of subacute and subclinical cases once it becomes endemic. In subacute disease, the mortality rate ranges from 30% to 70%, and may differ between age groups. Mild or asymptomatic disease is usually seen in warthogs and bush pigs.
Slide 20	**TRANSMISSION**	
Slide 21	Transmission • Direct contact with infected pig – Usually oronasal – All secretions/excretions, blood, tissues • Environmental contamination with products • Ingestion of contaminated pork products – Fed to pigs – swill, waste, garbage – Carcasses	Transmission of ASF virus can occur by direct and indirect contact with infected animals, their body fluids or tissues. Transmission of the virus can occur by direct contact of susceptible pigs with infected swine. Exposure is most commonly oronasal (e.g., saliva, ocular secretions, nasal discharge) as the virus is found in all secretions and excretions from infected animals. ASFV can be found in all tissues and body fluids, with particularly high levels in blood, even after animal death. Some reports suggest that cannibalism of dead pigs may be important in transmission. Transmission can also occur indirectly, such as through the feeding of uncooked pork products. The transmission of ASF from country to country has been linked to the feeding of swill or garbage containing ASFV-infected pork products.
Slide 22	Transmission • Fomites – Clothing, vehicles, equipment – Environmental contamination • Blood, diarrhea, feces • Vectors – Biological: Bite from soft ticks *Ornithodoros* – Mechanical: Other insects • Mosquitoes, biting flies (*Stomoxys*)	ASF can also be transmitted indirectly by contaminated surfaces or fomites – contaminated inanimate objects – such as clothing, equipment, vehicles, or feed. Massive environmental contamination may result if blood is shed during necropsies or pig fights, or if a pig develops bloody diarrhea. The virus is estimated to survive for several days in feces, and possibly longer in urine. It can also persist in blood, meat, and frozen carcasses. Aerosol transmission is limited, but was reported in a laboratory setting over short distances when pigs were densely housed. It has been suggested that ASFV may be transmitted in outdoor pigs that have eaten grasses that were contaminated with

		secretions from infected wild boar. Bites from infected ticks may also spread the virus and will be explained further in the next slide. Mechanical transmission of ASFV by *Stomoxys* flies to domestic pigs has been demonstrated experimentally. Swine lice (*Haematopinus suis*) have also been shown to carry ASFV in a study of experimentally infected swine.
Slide 23	Transmission • *Ornithodoros* soft ticks – Transstadial – Transovarial – Sexual transmission – Infected for life – Colonies maintain virus for years • Tick-to-pig transmission – Important in Africa – Maintained between warthogs and tick 	ASFV can be transmitted to pigs through the bite of infected soft ticks from the genus *Ornithodoros* – most frequently, *O. erraticus* and *O. moubata* (now called *O. porcinus porcinus*). Individual ticks can remain infected for three years or more, and infected soft tick colonies maintain the virus for years. ASFV can spread through some tick species by transstadial, transovarial, and sexual transmission. Individual ticks can remain infected for life, and infected soft tick colonies maintain the virus for years. In some regions of Africa, ASFV is thought to cycle between juvenile common warthogs and soft ticks that live in their burrows. O. *erraticus* ticks were reported in the Caucasus countries and in Russia. However, their role ASFV transmission has not been clearly defined in naturally occurring outbreaks. Some researchers believe that ASFV is actually a tick virus, and that the pig is an accidental host. [Photo: *Ornithodoros* tick (*Ornithodoros savignyi*) by Alan Walker from https://en.wikipedia.org/wiki/Ornithodoros#/media/File:Ornithodoros-savignyi.jpg is licensed under CC BY-SA 3.0]
Slide 24	**HUMANS ARE NOT SUSCEPTIBLE TO AFRICAN SWINE FEVER** There is no public health or food safety concern.	There is no evidence that ASFV infects humans. No human cases of ASF have been reported. There is no public health or food safety concern.
Slide 25	**AFRICAN SWINE FEVER IN ANIMALS**	
Slide 26	Clinical Disease • Incubation period – 5-21 days following direct contact – < 5 days after tick bite • Forms of disease – Peracute – sudden death – Acute – Subacute – Chronic	The incubation period of ASF is 5 to 21 days following direct contact with infected pigs, but can be less than 5 days after exposure to infected ticks. African swine fever can be a peracute, acute, subacute or chronic disease. Some animals can seroconvert without developing clinical signs. Sudden death with few lesions (peracute disease) may be the first sign of an infection in a herd.

Slide 27

Clinical Signs: Acute Disease

- High fever
- Anorexia
- Lethargy
- Weakness, recumbency
- Erythema, cyanosis
- Hemorrhages
  - Skin, snout


Acute cases of ASF are characterized by high fever, anorexia, lethargy, weakness, and recumbency. Erythema can be seen, and is most apparent in white pigs (top photo). Some pigs develop cyanotic skin blotching, especially on the ears, tail, lower legs or hams.

[Photos: Left: Multiple sharply demarcated foci of cutaneous hemorrhage and/or necrosis; hemorrhagic lesions may contain dark red (necrotic) centers. Right: A large sharply demarcated zone of hyperemia. Photo source: Plum Island Animal Disease Center]

Slide 28

Clinical Signs: Acute Disease

- Diarrhea
- Abortion
- Respiratory
  - Dyspnea
  - Nasal discharge
- Death
  - 7-10 days


Pigs may also have diarrhea, constipation, and/or signs of abdominal pain. The diarrhea is initially mucoid and may later become bloody. Abortions may be the first signs of an outbreak. Visible signs of hemorrhage, such as epistaxis and hemorrhages of the skin may be noted. Respiratory signs including dyspnea, nasal and conjunctival discharges and neurological signs have also been reported. Leukopenia and thrombocytopenia may be detected in laboratory tests. Death often occurs within 7 to 10 days.

[Photos: Top: Bloody, mucoid, foamy nasal discharge. Bottom: There is marked hyperemia of the distal limbs. Photo source: Plum Island Animal Disease Center]

Slide 29

Clinical Signs: Subacute Disease

- Moderately virulent isolates
- Similar signs to acute form, but less severe

Subacute disease is caused by moderately virulent isolates of the ASF virus. Clinical signs are similar to the acute form but with less severe presentation. Abortions may be the first sign. Fever, thrombocytopenia and leukopenia may be transient in this form. Hemorrhages can occur during the period of thrombocytopenia. Affected pigs usually die or recover within 3 to 4 weeks.

Slide 30

Clinical Signs: Chronic Disease

- Intermittent, low fever
- Anorexia, depression
- Emaciation, stunting
- Respiratory: coughing
- Joint swelling
- Diarrhea
- Occasional vomiting
- Skin lesions
- May be fatal

Pigs with the chronic form can have intermittent low fever, appetite loss, and depression. The signs may be limited to emaciation and stunting in some animals. Other pigs develop respiratory problems and swollen joints. Coughing is common, and diarrhea and occasional vomiting have been reported. Ulcers and reddened or raised necrotic skin foci may appear. Chronic African swine fever can be fatal.

[Photos: Top and bottom: Multiple sharply demarcated foci of cutaneous hemorrhage and/or necrosis. Photo source: Plum Island Animal Disease Center]

Slide 31

Post-Mortem Lesions

- Numerous hemorrhagic internal organs
- Skin
  - Discoloration
  - Hemorrhages
- Signs of bloody diarrhea or internal hemorrhages


The gross lesions of ASF are highly variable, and are affected by the virulence of the isolate and the course of the disease. Numerous organs may be affected, to varying extent, in animal with acute or subacute ASF. The carcass is often in good condition in animals that die acutely. There may be bluish-purple discoloration and/or hemorrhages in the skin, and signs of bloody diarrhea or other internal hemorrhages. The major internal lesions are hemorrhagic, and occur most consistently in the spleen, lymph nodes, kidneys and heart.

[Photo: Post-mortem lesions caused by African swine fever virus. (Top) Pig heart with abundant straw-colored pericardial fluid (hydropericardium), and multifocal epicardial hemorrhage. (Bottom) This pig cecum shows mucosa that is markedly edematous and hyperemic, and lymph nodes that are hemorrhagic. Source: Source: Plum Island Animal Disease Center]

Slide 32

Post-Mortem Lesions

- Spleen
  - Enlarged
  - Friable
  - Dark red/ black

With highly virulent infections, the spleen is usually enlarged, friable, and dark red or black. With moderately virulent infection, the spleen is enlarged but not friable, with a nearly normal color.

[Photo: Post-mortem lesions caused by African swine fever virus. A greatly enlarged dark red to black spleen. Source: Foreign animal Diseases: The Gray Book from www.aphis.usda.gov/emergency_response/downloads/nahems/fad.pdf]

Slide 33

Post-Mortem Lesions: Most Common

- Lymph nodes
  - Swollen
  - Hemorrhagic
  - Gastrohepatic and renal LN common
  - Tonsils: swollen, reddened

Lymph nodes are often swollen and hemorrhagic, and may look like blood clots. The lymph nodes most often affected are the gastrohepatic and renal lymph nodes. The tonsils may also be swollen or reddened.

[Photos: Post-mortem lesions caused by African swine fever virus. Left: Mandibular lymph nodes with moderate peripheral (medullary) hemorrhage. Right: The gastrohepatic lymph node is markedly enlarged and hemorrhagic, and the adjacent lesser omentum is edematous. Source: Plum Island Animal Disease Center]

Slide 34

Post-Mortem Lesions: Most Common

- Kidneys
  - Petechiae on cortical and cut surfaces
  - Perirenal edema possible

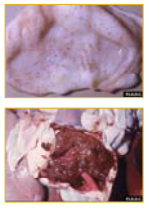
Petechiae are common on the cortical and cut surfaces of the kidneys, and sometimes in the renal pelvis. Perirenal edema may be present.

[Photos: Post-mortem lesions caused by African swine fever virus. Left: Kidney cortex that contains numerous coalescing petechiae and ecchymoses. Right: Petechiae are disseminated throughout the cortex, and there are larger coalescing pelvic hemorrhages. Source: Plum Island Animal Disease Center]

Slide 35

Post Mortem Lesions

- Other organs
  - Hemorrhages, petechiae, ecchymoses
- Edema
  - Lungs, gall bladder
- Brain/meninges
  - Congested, edema



Hemorrhages, petechiae and/or ecchymoses are sometimes detected in other organs including the urinary bladder, lungs, stomach and intestines. Pulmonary edema and congestion can be prominent in some pigs. There may also be congestion of the liver and edema in the wall of the gall bladder and bile duct, and the pleural, pericardial and/or peritoneal cavities may contain straw-colored or blood-stained fluid. The brain and meninges can be congested, edematous, or hemorrhagic.

[Photos: Post mortem lesions caused by African swine fever virus. Top: Pig urinary bladder with disseminated mucosal petechiae. Bottom: This pig stomach is filled with clotted blood and the wall is markedly edematous. Source: Plum Island Animal Disease Center]

Slide 36

Post Mortem Lesions: Chronic Infection

- Focal skin necrosis
- Skin ulcers
- Consolidated lung
- Caseous pneumonia
- Fibrinous pericarditis
- Pleural adhesions
- Lymphadenopathy
- Swollen joints

In animals with chronic African swine fever, the carcass may be emaciated. Common post mortem lesions include focal skin necrosis (top photo), skin ulcers, consolidated lung lobules (bottom photo), caseous pneumonia, nonseptic fibrinous pericarditis, pleural adhesions, generalized lymphadenopathy and swollen joints. Some lesions may result from secondary infections.

[Photos: Post mortem lesions caused by African swine fever virus. Top: Necrotic exudate is sloughing from the lesion on the left. There is a rim of hyperemia around the focus of hemorrhage and necrosis (infarct) on the right. Bottom: The lung is non-collapsed and edematous; there is dorsal hemorrhage and ventral tan consolidation. Source: Plum Island Animal Disease Center]

Slide 37

Differential Diagnosis

- Classical swine fever (hog cholera)
- Acute PRRS
- Porcine dermatitis and nephropathy syndrome
- Erysipelas
- Salmonellosis
- Eperythrozoonosis
- Actinobacillosis
- Glasser's disease
- Aujeszky's disease (pseudorabies)
- Thrombocytopenic purpura
- Warfarin poisoning
- Heavy metal toxicity

The differential diagnoses for ASF are numerous and signs can resemble many different diseases. Hog cholera (more commonly known as classical swine fever) is clinically indistinguishable from ASF. Other diseases with similar signs may include acute porcine reproductive and respiratory syndrome (PRRS), erysipelas, salmonellosis, eperythrozoonosis, actinobacillosis, Glasser's disease (*Haemophilus parasuis* infection), Aujeszky's disease (pseudorabies), thrombocytopenic purpura, warfarin poisoning, heavy metal toxicity, and other generalized septicemic or hemorrhagic conditions.

Slide 38

Sampling

- Before collecting or sending any samples, the proper authorities should be contacted
- Samples should only be sent under secure conditions and to authorized laboratories to prevent the spread of the disease

Before collecting or sending any samples from animals with a suspected foreign animal disease, the proper authorities (state and/or federal veterinarian) should be contacted. Samples should only be sent under secure conditions and to authorized laboratories to prevent the spread of the disease.

Slide 39

Actions To Take

- Reportable disease
- If ASF suspected, IMMEDIATELY notify animal health authorities
  - In the U.S.
    - USDA Assistant Director (AD)
    - State Animal Health Official
- Isolate/quarantine animals until definitive diagnosis received

A quick response is vital for containing outbreaks in ASFV-free regions. Veterinarians who encounter or suspect African swine fever should follow their national and/or local guidelines for disease reporting. In the U.S., state or federal veterinary authorities should be informed immediately. Animals suspected with ASF should be isolated, and the farm should be quarantined until definitive diagnosis is determined.

- USDA Assistant Director (AD) https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/contact-us/CT_Vet_Acred_Asst_DD
- State Animal Health Official http://www.usaha.org/upload/Federal%20and%20State%20Health/StateAnimalHealthOfficials_rev.pdf

Slide 40

Diagnosis

- Virus isolation
  - Blood, tissues
- PCR
  - Clinical samples, putrefied samples, fresh tissues/blood
  - Tonsils for FAD investigation
- Serological
  - ELISA
  - Immunoblotting
  - Indirect fluorescent antibody (IFA)
  - Smears, cryostat, buffy coat
  - Endemic regions

African swine fever can be diagnosed by virus isolation. The virus can be detected in blood from live animals or tissues (e.g., spleen, kidneys, tonsils, lymph nodes are best) collected at necropsy, but is not found in aborted fetuses. Virus isolation is typically used for reference laboratories to confirm diagnosis. PCR is often used to detect ASFV nucleic acids in clinical samples. It can be employed with putrefied samples, which are unsuitable for virus isolation and antigen detection, as well as with fresh tissues or blood. In October 2018, USDA approved both whole blood and tonsil for ASF PCR during a foreign animal disease investigation with processing at approved laboratories. Serological assays can be very useful, especially in endemic regions. ASFV antigens may be found in tissue smears or cryostat sections, as well as in buffy coat samples, using ELISAs or immunofluorescence. ELISAs, immunoblotting and indirect fluorescent antibody (IFA) tests are most common. The ELISA is prescribed for international trade, and is generally confirmed by immunoblotting (although IFA can also be used).

Slide 41

Treatment

- No treatment available
  - No treatment should be attempted
- No vaccine available
- Response should be directed by animal health authorities
- Depopulation
- Restrictions on pig movements

No treatment or vaccine currently exists for ASF. Treatment should not be attempted for pigs suspected with ASF. To date, all attempts to develop a vaccine against ASFV have been unsuccessful. Instead, response should be directed by appropriate animal health authorities. Confirmed cases and in-contact animals should be euthanized, and measures taken to protect other pigs in the area. This may entail complete herd depopulation combined with animal movement restrictions.

Slide 42

PREVENTION

Slide 43

Prevention

Prevent direct transmission between infected and susceptible swine

- Isolate ill pigs
- Prevent contact with feral or wild hogs; when possible house pigs indoors
- Keep newly acquired pigs separate from the herd for at least 30 days to assure health

Preventing the introduction or spread of ASF focuses on disrupting the means of virus transmission. First, to prevent direct contact transmission, practice good farm biosecurity measures to prevent contact between any infected and susceptible swine. This should include the isolation of any ill pigs from the herd, preventing contact of pigs with feral or wild hogs; when possible housing pigs indoors, and keeping newly acquired pigs separate from the herd for at least 30 days to assure health.

Slide 44

Prevention

Prevent indirect transmission

- Do not feed uncooked pork products to pigs
  - Swill, garbage, waste
- Disinfection
  - Vehicles, equipment, footwear, clothing
- Appropriate disposal of manure and carcasses
- Avoid hunting wild hogs prior to contact with domestic pigs

Prevent vector transmission

- Control tick and other insect vectors
- May be difficult in endemic areas

Prevent indirect transmission of the virus by avoiding the feeding of uncooked or undercooked pork products, raw pork waste or garbage to pigs. This is considered a high risk practice and should be avoided or measures to ensure heating of these materials is adequate to destroy the virus. Ensure the appropriate disposal and treatment of manure and swine carcasses, including blood or bodily fluids. Feces from ASFV pigs contains large amounts of the virus. Implement proper cleaning and disinfection procedures for vehicles, equipment, footwear, or clothing. Implement vector control measures to prevent ticks, flies, and mosquitoes. This is especially important in areas where competent tick vectors are found. An additional precautions may include avoiding contact with domestic pigs for 48 hours after hunting or contact with feral or wild pigs. Informing and educating producers on the risks and prevention measures can help enhance the protection of domestic pigs. Prevent vector transmission by controlling ticks and other potential disease vectors. This may be difficult in endemic areas.

Slide 45

CONTROL

Slide 46

Control Measures

- Quarantine of farm
- Authorities notified
- Movement restrictions
- Investigation
- Rapid diagnosis
- Determine source of virus

As previously mentioned, ASF is a highly contagious and reportable disease. Once suspected or detected, efforts to control the spread of the disease and identify the source of the virus must be taken. Strict quarantine must be imposed if ASF is suspected. The entire herd should be quarantined immediately until authorities are notified and a diagnosis is confirmed. Movement restrictions may be imposed while investigation, diagnosis, and determination of the source of the virus are in progress.

[Photos: (Left) Disease control area signage. Source: ISU VDPAM; (Right) Trace back and trace forward graphic. Illustration by CFSPH Iowa State University]

Slide 47

Disinfection

- Many disinfectants ineffective
  - Use an product approved for the virus
  - Feces and organic debris can increase resistance of virus
- Disinfectants on nonporous surfaces
  - Sodium hypochlorite, citric acid, some iodine and quats
- Disinfect premises, equipment, vehicles, footwear

Since many common disinfectants are ineffective, care should be taken to use a disinfectant specifically approved for the virus. Disinfection of equipment, vehicles, and personal protective equipment (shown above) is essential when there has been exposure to an area with suspicion or confirmed diagnosis of ASF. Sodium hypochlorite, citric acid (1%) and some iodine and quaternary ammonium compounds are reported to destroy ASFV on some nonporous surfaces.

[The top photo shows the inside of an animal trailer being disinfected. Source: Dr. Danelle Bickett-Weddle, Iowa State University, College of Veterinary Medicine]

Slide 48

Eradication

- Euthanize/depopulation of infected and in-contact animals
- Proper carcass disposal
  - To avoid further spread
- Sanitation/disinfection
- Movement controls/quarantines
- Avoid contact with wild suids

Successful eradication is accomplished by rapid diagnosis, depopulation and proper disposal of all infected or in-contact swine on the infected premises. Disposal of carcasses will be necessary and must follow animal health official guidelines.

Additionally, measures to ensure proper carcass disposal, sanitation/disinfection, movement controls and quarantines, and the prevention of contact with wild suids must be taken.

Slide 49

U.S. Disease Response Strategy

- USDA FAD PReP
- Stamping out approach
  - Depopulation
  - Surveillance and investigation
  - Quarantine and movement control
  - Wildlife management and control

https://www.aphis.usda.gov/animal_health/emergency_management/downloads/asf_strategies.pdf

The U.S. Department of Agriculture (USDA) has outlined a disease response strategy for African Swine Fever as part of its Foreign Animal Disease Preparedness and Response Plan (FAD PReP). The primary control and eradication strategy for ASF in domestic swine in the United States is a stamping-out approach, which will involve the depopulation of clinically affected and in-contact susceptible swine. (USDA FAD PReP)

Slide 50

Additional Resources

- CFSPH Technical Factsheet - African Swine Fever
  http://www.cfsph.iastate.edu/Factsheets/pdfs/african_swine_fever.pdf
- USDA FAD PReP Disease Response Strategy for African Swine Fever
  https://www.aphis.usda.gov/animal_health/emergency_management/downloads/asf_strategies.pdf
- OIE Technical Disease Card: African Swine Fever
  http://www.oie.int/en/animal-health-in-the-world/animal-diseases/african-swine-fever/
- USAHA Foreign Animal Diseases ("The Gray Book")
  http://www.aphis.usda.gov/emergency_response/downloads/nahems/fad.pdf

For additional information on African swine fever, consult these resources.

Slide 51	**References** • Bellini S et al. Preventive measures aimed at minimizing the risk of African swine fever virus spread in pig farming systems • Brown VR et al. A review of African swine fever and the potential for introduction into the united states and the possibility of subsequent establishment in feral swine and native ticks. *Frontiers in Veterinary Science* 2018;5:11 • Jurado C et al. Relevant measures to prevent the spread of African swine fever in the European Union domestic pig sector. *Frontiers in Veterinary Science* 2018;5:77 • Krug PW et al. Chemical disinfection of high-consequence transboundary animal disease viruses on nonporous surfaces. *Biological* 2011;39;231-235	In addition to the resources listed on the previous slide, these references were used for the development of this presentation.
Slide 52	**Acknowledgments** Development of this presentation was made possible through grants provided to the Center for Food Security and Public Health at Iowa State University, College of Veterinary Medicine from the Centers for Disease Control and Prevention, the U.S. Department of Agriculture, the Iowa Homeland Security and Emergency Management Division, and the Multi-State Partnership for Security in Agriculture. ***Authors:*** *Glenda Dvorak, DVM, MPH, DACVPM; Reneé Dewell DVM,MS; Anna Rovid Spickler, DVM, PhD; Kerry Leedom Larson, DVM, MPH, PhD; Jean Gladon, BS, DVM* ***Reviewers:*** *James A. Roth, DVM, PhD; Pam Zaabel, DVM; Jane Galyon, MS; Bindy Comito, BA; Katie Spaulding, BS* Center for Food Security and Public Health, Iowa State University, 2018	Last reviewed: October 2018