

African swine fever

A deadly disease of piggyery

Ajay Kumar Yadav*, Seema Rani Pegu, Rajib Deb, Mukesh Bhatt, Ashok Kumar, Vishal Rai, Kaushal Kishor Rajak and Swaraj Rajkhowa

ICAR–National Research Centre on Pig, Rani, Guwahati, Assam 781 131

African swine fever is a highly contagious deadly viral disease of pigs, caused by large DNA virus of the family Asfarviridae known as Asfivirus. The virus causes mortality upto 100% in the affected flocks. The disease was first time indentified in Kenya in the year 1921 and since then it has spread to several African and European countries. In 2018, it was been reported from China and 2019 from neighbouring countries of India like Bangladesh, Myanmar, Vietnam, Combodia and Bhutan. The disease has been reported from India in the month of May, 2020 and reported to OIE. The disease has serious economic lose to the farmers and poses restriction in the sale of live pigs and pork products. At present, there is no successful vaccine against this disease. So, only early diagnosis and confinement of the diseased animal in a particular localized area is the main target. The only solution of this disease is the strict bio-security measures at the state borders and at the level of individual pig farms.

Keywords: African swine fever, Domestic cycle, *Ornithodoros*, Sylvatic cycle

AFRICAN swine fever (ASF) is a highly contagious haemorrhagic viral disease of domestic and wild pigs, responsible for serious economic and production losses. The disease is caused by a large DNA virus of the Asfarviridae family, which also infects ticks of the genus *Ornithodoros*. Although signs of ASF and classical swine fever (CSF) may be similar, the ASF virus is unrelated to the CSF virus. ASF is notifiable and Transboundary Animal Disease (TAD); listed in the World Organization for Animal Health (OIE) Terrestrial Animal Health Code and must be reported to the OIE. In February 2020, high mortality rate in pigs were noticed in some districts of upper Assam and it was also traced back that pig mortalities with similar nature were reported from Arunachal Pradesh and later spreaded to Assam. The disease was first time reported in India in May 2020, after confirmation of the ASF virus by National Institute of

High Security Animal Diseases, Bhopal followed by World Organization for Animal Health (OIE).

Causative agent

ASF is caused by a virus known as African Swine Fever Virus (ASFV). ASFV is a large, enveloped, double-stranded DNA virus which belongs to the genus Asfivirus under family Asfarviridae. Its DNA genome varies from 170-190 kbp dsDNA. It is the only DNA virus having the arboviral (arthropod-borne-virus) property and the only member of the genus Asfivirus but it has more than 23 (I-XXIII) distinct genotypes. The virus maintains in the pig population by following two types of cycles namely 'Domestic cycle' (between domestic pigs and *Ornithodoros* ticks) and 'Sylvatic cycle' (between warthogs and *Ornithodoros* ticks). The warthogs, bushpigs and *ornithodoros* ticks are considered to be reservoir of the virus (Fig. 1).

ASF virus is highly stable and temperature resistant and can persist in the environment for a long time. Virus remains viable for a long periods in blood, faces and tissues; especially infected, uncooked or undercooked pork products. Virus is highly resistant to low temperatures, heat inactivated by 56°C/70 min; 60°C/20 min. Virus is inactivated by pH <3.9 or >11.5 in serum-free medium. Serum increases the resistance of the virus, e.g. at pH 13.4—resistance lasts up to 21 hrs without serum, and 7 days with serum. ASF virus is susceptible to ether and chloroform and inactivated by 8/1000 sodium hydroxide (30 min), hypochlorites—2.3% chlorine (3 min), 3/1000 formalin (30 min), 3% ortho-phenylphenol (30 min) and iodine compounds. The ASF virus can persist in the frozen meat and meat products for months even upto several years.

All the members of family Suidae are susceptible to African swine fever

virus infection. Domestic swine (*Sus scrofa domesticus*), wild boars (*Sus scrofa ferus*), Warthogs (*Phacochoerus* spp.), Bush pigs (*Potamochoerus porcus*) and Giant forest hogs (*Hylochoerus* spp.).

ASF virus does not affect human beings means there is no zoonosis.

Transmission of the ASF

There are three modes of transmission for ASF: direct, indirect, and vector-borne. Direct transmission occurs when infected animals come into contact with healthy animals. Contact with infective saliva, nasal secretion, respiratory secretions, urine and faeces are effective means of transmission due to the high levels of viral load. The presence of wild pigs is the most prognostic risk factor of the disease spread. The indirect mode of transmission occurs via contaminated feed and water (faecal-oral transmission), fomites, infected blood, farm utensils, pig-farm waste, contaminated feed, farm machineries and tools etc. This mode of transmission can be particularly important in introducing ASF to disease-free areas. Lastly, argasid ticks (*Ornithodoros* spp.) serve as a vector for transmission of the disease, passing the virus to swine hosts when taking their blood meal. Infected

ticks are also able to transmit ASFV to other ticks (sexual transmission), to their offspring by passage of the virus to the eggs (transovarial transmission) and from one life cycle stage to another (transstadial transmission) (Fig. 2).

The incubation for ASFV varies by route of transmission. For direct contact with ASFV-infected pigs, the incubation period is between 5–21 days. When bitten by an *Ornithodoros* tick, incubation period this can be less than 5 days.

Clinical signs and symptoms

There are four types of presentation of disease, peracute, acute, subacute and chronic forms based on the genotype associated virulence and pathogenesis of the virus. Animals infected with the peracute form of ASF death is often the first indication of disease. Cases infected with the acute form may develop fever (40.5–42°C), anorexia, listlessness, cyanosis, incoordination, increased pulse and respiratory rate, leukopenia and thrombocytopenia (at 48–72 h), vomiting, diarrhea, and abortion in pregnant sows. Any survivors become carriers of the virus for lifelong. Swine infected with sub acute forms of ASF present with similar though less intense symptoms

as described for the acute form, this includes slight fever, reduced appetite, and depression. Abortion in pregnant sows is also possible and can be an early sign (Table).

Diagnosis of the disease

ASF may be suspected based on clinical signs, but confirmation must be made with laboratory tests, particularly to differentiate it from classical swine fever (CSF). Guidance on diagnostic tests for ASF can be found in the Manual of Diagnostic Tests and Vaccines for Terrestrial Animals.

Samples of blood, serum, spleen, tonsil, and gastrohepatic lymph nodes from suspected cases should be submitted to the laboratory for confirmation. Virus isolation considered to be the ‘gold standard’ for the diagnosis of ASF. Virus can be isolated by inoculation of primary cultures of pig monocytes, in which it produces hemadsorption of pig red cells to the surface of infected cells. Confirmation of ASF can be done by either PCR (based on p72/p54 gene) or an antigen-detection ELISA. Viral antigen can be detected in infected tissue smears or sections by staining with labeled antibodies (several enzyme-labeled tests are available, and viral DNA by PCR or

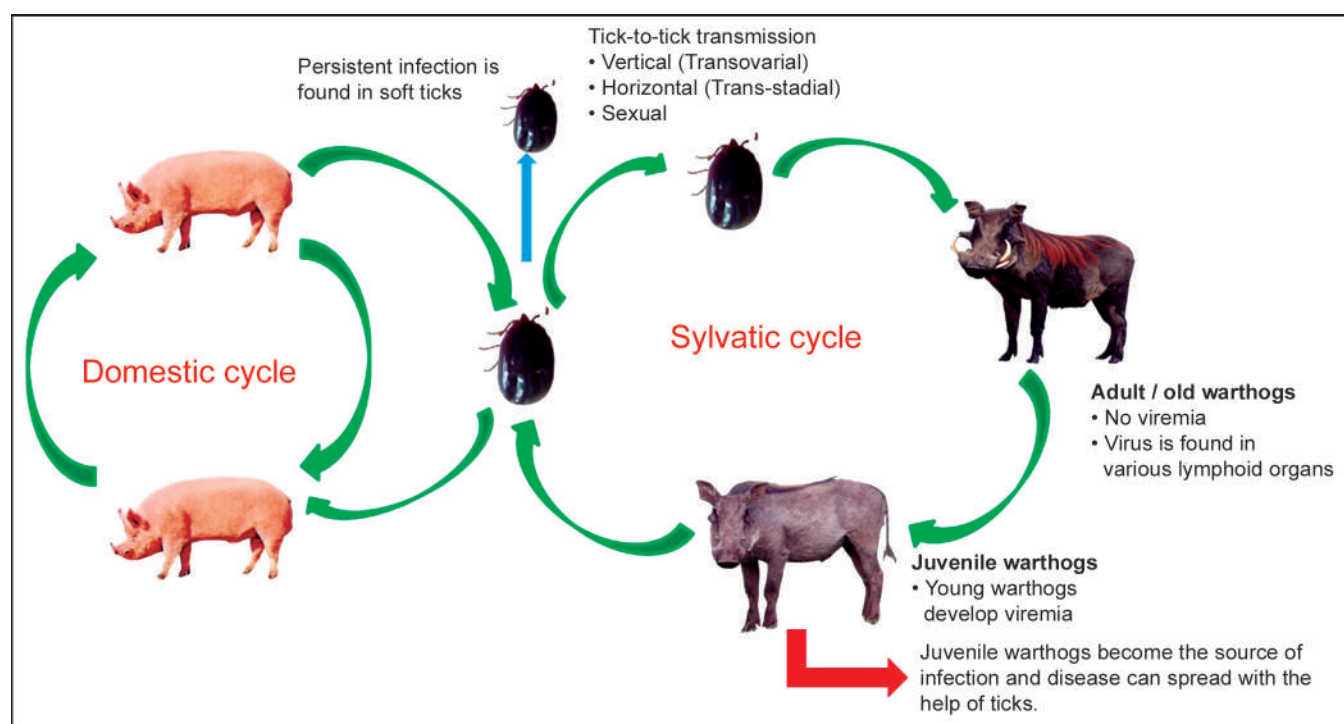


Fig. 1. Maintenance of African Swine Fever among domestic and wild boars through 'Domestic and Sylvatic cycles'.

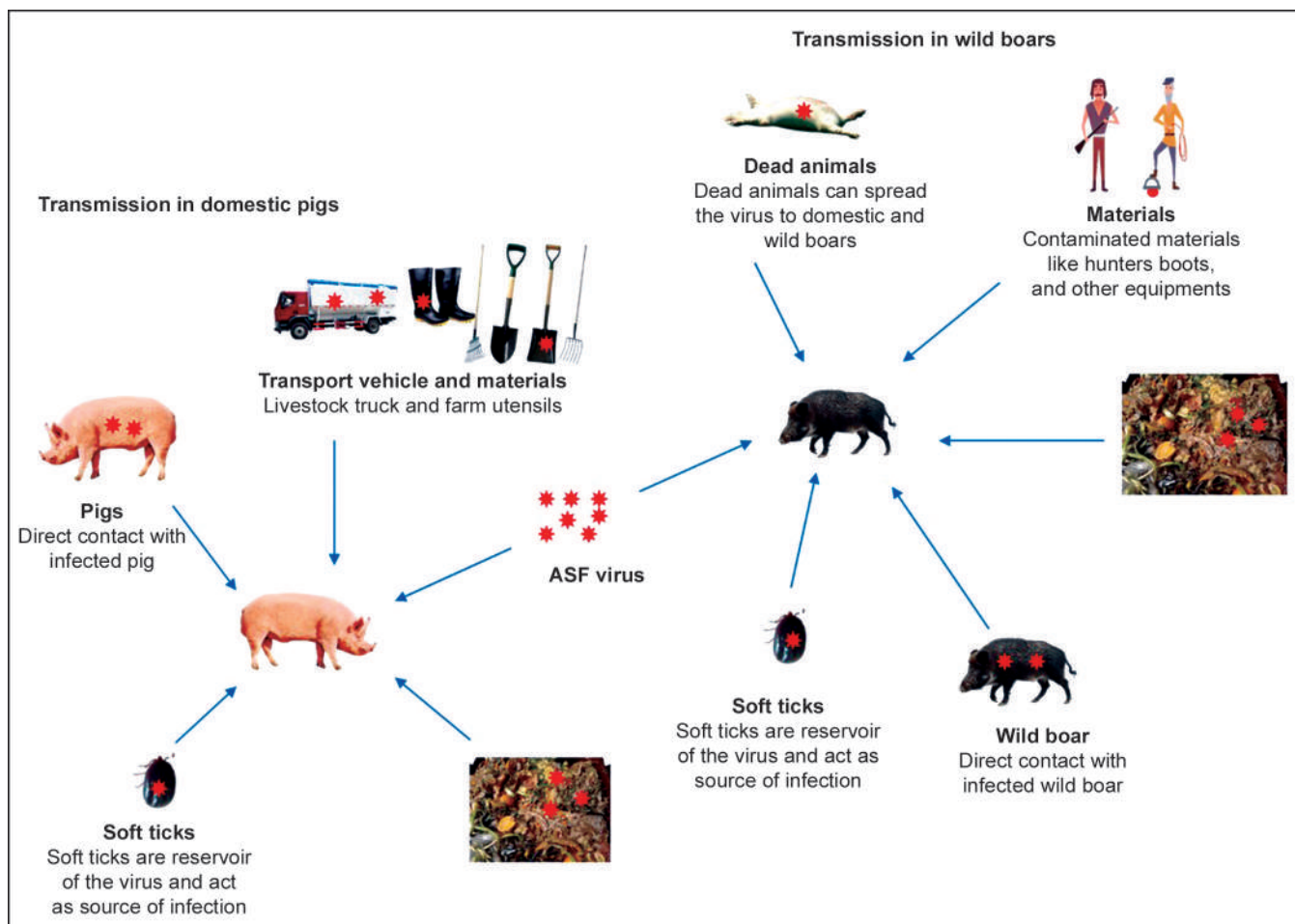


Fig. 2. Transmission of ASF involving direct, indirect mode and through tick (vector) in domestic and wild pig population

hybridization of nucleic acid probes to tissue sections. The most appropriate tests to detect antibody in serum or tissue fluids are the ELISA and indirect immunofluorescence. Other differential diagnoses include hemorrhagic bacterial infections and certain types of poisons.

Prevention and control

As of today, there is no cure and treatment of the disease. There is no vaccine against ASF in the world. So, prevention is the only option to control the disease or limits its transmission. In the present situation, prevention by adopting the strict biosecurity guidelines is the only solution for this disease.

Biosecurity guidelines to prevent introduction of ASF in the pig farm or disease-free area

- Visitors and vehicles should not be allowed in the farm premises. If there is necessity then the vehicle's tyres, wheels and visitors' (any outside person) shoes/boots should be disinfected with 2% sodium hypochlorite or 3:1000 potassium permanganate solutions.
- There should be provision of foot dip at the main gate of farm and also at entrance and exits of individual pig farm/pen. These foot dips with proper disinfectant solutions should be made mandatory at the entry point of each pig shed. There are several chemicals which can be used in foot dip like potassium permanganate (3:1000), 2% sodium hydroxide, 1% formaldehyde, 1% bleaching powder or 1% calcium hydroxide (lime) etc.
- The farm premises and pig shed should be cleaned regularly with high pressure water and disinfect the pig shed and premises by ASFV approved disinfectants like 2% NaOH, 1-2% sodium hypochlorite, 1% formalin, 3% ortho-phenylphenol, 2-3% iodine compounds, quaternary ammonium compounds and some multi-constituent compounds (Virkon, Lysoformin, Verocid) etc.
- Hands of the farm workers should be properly washed before entry into the farm and also after completion of work. Hands should be washed with detergent based soap.
- Wearing of specific dresses by the farm workers/personnel before entry to the farm till the completion of work should be made compulsory.
- Farm workers/personnel and visitors leaving the farm should ensure that their shoes, clothing and equipment are disinfected.
- Proper record keeping of animal health and entry and exit of visitors should be maintained.
- If any pig suffers from the disease, it should immediately be separated from the healthy stock and should be reared in quarantine shed till it is fully recovered.

Table 1.

	Per-acute	Acute	Sub acute	Chronic
Virulence of the strain	Highly virulent strain	Highly virulent strain	Moderate to low virulent	Low virulent strain
Immune status	Death before sero conversion	Many pig die before seroconversion	Seropositive	Seropositive
Clinical signs	Often found moribund or dead without any specific clinical signs, Only high fever can be observed.	Febrile (40.5°C –41.5°C), leukopenia, anorexia, blood in feces, to, reluctant to move, erythemic skin progressing	Variable but typically, similar though less severe than acute ASF	Mild fever for 2–3 weeks; pregnant sows may abort; reddened then to cyanosis near death dark, raised, dry, and necrotic skin lesions, especially over pressure points. loss of weight, respiratory signs, chronic skin ulcers, and arthritis, emaciation, swollen joints.
Morbidity and Mortality	100%	Upto 100%	70–80% in young pigs < 20% in older pigs	Low mortality 30-70%
Gross lesions	Death occurs before distinct lesions form	Spleen enlarged (upto 3 times normal), dark and friable; multiple hemorrhages of internal organs, especially kidneys and heart; hemorrhagic lymph nodes; edema of gall bladder and lungs; congestion of meninges choroid plexus	Lesions are similar but milder than acute ASF; spleen may be 1.5 times normal size; lymph nodes enlarges but only mildly hemorrhagic; few petechial on kidneys	Fibrinous pleuritis, pleural adhesions, caseous pneumonia, hyperplastic lymphoreticular tissues, nonseptic fibronous pericarditis, necrotic skin lesions

- Any suspected cases of ASF should be immediately reported to Veterinary doctors and to the District Veterinary Officer.
- There should always be separate workers for handling with diseased and healthy animals.
- Pigs should be purchased from authorized source. Do not purchase pigs from unauthorized or unknown source.
- Newly purchased pigs should not be mixed immediately with other pigs. It should be kept in quarantine for 30-45 days and monitor daily.
- After quarantine period (30-45 days), pigs should be screened for the presence of disease and if found negative then introduce it into the farm.
- Pigs should not be allowed to mingle with other pigs, wild boar and other animals.
- No diseased pigs should be sold to traders/ butchers.
- Swill feeding (kitchen waste, hotel waste, airport waste or pig meat) should be prohibited and if practiced, it should be boiled properly before feeding.
- Sharing of equipment among farms/villages should be discouraged without proper cleaning and disinfection.
- Farm utensils used for feeding of diseases pigs should not be used for healthy pigs.
- Movement of animals from one farm to another farm or from one village to another village or any animal fairs should be strictly prohibited.
- Movement of personnel (veterinarians and farm workers) from one farm premises to another is prohibited.
- Management of animal health including regular deworming and minerals and vitamins supplements.
- Regular spraying of acaricides to control tick is mandatory. There should not be any cracks and crevices in the farm buildings.
- Stringent environment friendly measures should be adopted for proper disposal of farm waste.
- Dead pigs, effluents and discarded parts from slaughtered pigs should be disposed off appropriately out of the reach of wild or free-ranging pigs. Proper disposal of dead carcass with deep burial of 6 feet deep using lime/bleaching powder.
- Recently ICAR-NRC on Pig has developed an App on African swine fever covering the various aspects of disease to create awareness among the farmers and stakeholders to reduce the economic losses (link to the App <https://play.google.com/store/apps/details?id=com.kgec.africanswinefever>).

FAO's recommendations for the control of African swine fever

ASF virus can be transmitted through pork and pork products (raw/frozen/dried/under-cooked) in which the virus can survive for a long time. Warning signs should be placed clearly at the border/customs entry including airports and seaports, stating the consequences of bringing

pork and pork products from ASF-infected countries/regions, and instructing passengers to discard pork products in designated disposal places or to hand over to the customs personnel.

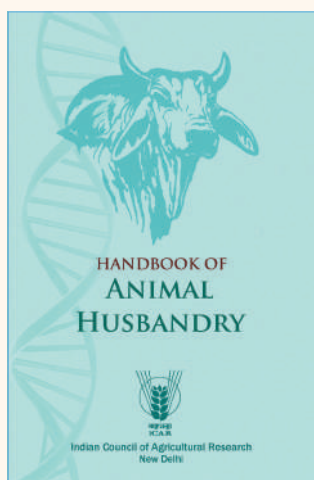
FAO recommendation for ASF

- Animal disease containment, in its broadest sense, should be prioritized within the highest levels of governments.
- Preparedness (e.g., contingency planning, standard operating procedures—SOPs, secured financial support) for improved early warning, detection and notification, early reaction, and coordination needs to be in place and reviewed periodically in relation to changing disease situation.
- Application of strict biosecurity measures specific to the different swine producing sectors including frequent cleaning and disinfection of farms, transport vehicles, and improved husbandry practices and production systems.
- Strengthening surveillance and monitoring of transport of live pigs as well as pork products.
- Good communication and coordination with swine producing commercial sector and swine farmers are essential to strengthen cooperation in ASF prevention, detection, and control. Awareness and training of all stakeholders, from veterinarians to farmers, intermediaries, and other value chain actors, is needed.
- communication with the public proper to avoid rumours leading to food safety perceptions and consumption disruption, as ASF has no public health hazard issues.
- Farm registries, animal identification, and censuses are essential to enable animal health interventions.
- Strengthening the proper disposal of food waste (food services, airports, seaports), which may contain uncooked pork products.
- Outbreak control strategies must be in place. The strategies need to be developed in consultation with the private sector (pig producers and allied industries, such as transport, feed operators) for improved disease management options and compliance.

Corresponding author e-mail:
dr.ajayyadav07@gmail.com

HANDBOOK OF ANIMAL HUSBANDRY

Livestock sector has created a significant impact on equity in terms of employment and poverty alleviation. After staple crops, livestock sector is the second most important contributor to the agricultural economy. The



producer prices of meat, eggs and milk, in India appear to be highly competitive as the domestic producer prices of these products are quite low compared to the ex-farm gate prices of major exporters in the world markets. A knowledge resource is essential to harness the potential of animal production. The Indian Council of Agricultural Research brought out first edition of *Handbook of Animal Husbandry* in 1962 for serving the end-users ranging from livestock owners to academicians. This is the Fourth revised and enlarged edition of *Handbook of Animal Husbandry* which includes 48 chapters under nine sections, such as Animal Genetics and Breeding; Animal Nutrition and Feed Technologies; Animal Management; Animal Reproduction; Animal Health Management; Animal Biotechnology; Animal Products, Technology and Machineries; Economics and Trade of Livestock and Poultry Enterprise; and Social Sciences. It has 19 new chapters like Impact of Biotechnology, Nanotechnology: Applications in Animal Sciences; Carbon Trading: Mechanisms and Opportunities in Livestock Sector; Intellectual Property Rights

Regime; Indigenous Technical Knowledge etc.; and old chapters were revised holistically. The fourth revised and enlarged edition of *Handbook of Animal Husbandry* will prove useful to the students, teachers, livestock/poultry farmers, and to especially those who visualize the economic growth of country with the support of livestock sector.

TECHNICAL SPECIFICATIONS

No. of pages : i-x + 1550 • Price : ₹ 1500 • Postage : Rs 100 • ISBN No. : 978-81-7164-086-7

For obtaining copies, please contact:

Business Manager

Directorate of Knowledge Management in Agriculture
Indian Council of Agricultural Research
Krishi Anusandhan Bhavan-I, Pusa, New Delhi 110 012

Tel : 011-25843657, Fax 91-11-25841282; e-mail : bmicar@gmail.com