African Swine Fever

Lessons learned

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September 2018
Bern
ASF is a human driven disease
(“anthropogenic factors”)
ASF is a human driven disease ("anthropogenic factors")
1) **ASF will fade out rapidly** from the affected wild boar population due to the high mortality rate induced by the ASFV (*IMPLOSION*)

2) **ASF will spread rapidly westwards (Rabies like)** since an infected local wild boar population would infect the naïve neighboring populations within a short period of time initiating an epidemic wave... (*EXPLOSION*)
ASF: Working hypotheses for wild boar

1) ASF will fade out rapidly from the affected wild boar population due to the high mortality rate induced by the ASFV (IMPLOSION) years later.......

both hypotheses proved to be wrong !!!

2) ASF will spread rapidly westwards since an infected local wild boar population would infect the naïve neighboring populations within a short period of time initiating an epidemic wave...

(EXPLOSION) => Endemic in the region, slow spread
Afrikanische Schweinepest im Baltikum, Moldawien, Polen, Rumänien, Tschechien, Ungarn und Ukraine

Datenquelle: ADNS, OIE (Stand: 28.08.2018 - 08:25 Uhr) nach Feststellungsdatum; Restriktionsgebiete nach Anhang des Durchführungsbeschlusses 2014/709/EU

Haus- & Wildschwein (2018)
Haus- & Wildschwein (letzten 14 Tage)
Wildschwein (letzten 14 Tage)
Teil I (2014/709/EU)
Teil II (2014/709/EU)
Teil III (2014/709/EU)
1) Sylvatic cycle: the common warthogs; bushpigs and soft ticks.
2) Tick-pig cycle: soft ticks; domestic pigs.
3) Domestic cycle: domestic pigs and pig products.
4) Wild boar-habitat cycle: wild boar; pig- and wild boar products and carcasses; the habitat.

Chenais et al., 2018
How much do we need to know about ASF to be able to prevent, control and eradicate?

- Something about the virus
- Something about the clinical course
- Something about diagnosis
- Something about contagiosity, infectiosity, transmission...

- Much about epidemiology

- Very much about human-host interactions
- Very much about human behaviour
A bit about ASF

- Scientific information available
- Knowledge about ways & routes of transmission
- Diagnostic tools available

If we do not manage ASF, it’s not because of lack of knowledge…
ASF virus is relatively stable

- frozen meat: indefinitely
- dry meat and fat: almost one year
- blood, salted meat and offal: more than 3 months
- faeces: over one week

Temperature plays an important role in decreasing the survival duration of ASF virus in any matrix.

ASFV survives the process of putrefaction and carcasses may remain infectious for weeks
Textbooks are misleading...
copy/paste ...

“ASF is a highly contagious disease... causing high mortality up to 100%...”
Contagiousity/Contagiousness

percentage of animals which get infected after contact with an infectious agent.

*probability that an animal picks up an infection after contact with a pathogen*

It is NOT an indicator for disease severity and impact!!!

- Low contagious diseases with severe course and high impact
- Highly contagious diseases with mild course and low impact

Contagiousness

Probability of infection

<table>
<thead>
<tr>
<th>Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 30%</td>
<td>~ 50%</td>
<td>&gt; 60%</td>
</tr>
</tbody>
</table>
**ASF - CSF - FMD**

**FMD**
- Prevalence: 100%
- Mortality: 2%
- Lethality: 2%
- Contagiousity: +++

**100 infected; 2 dead**

**ASF**
- Prevalence: 10%
- Mortality: 9%
- Lethality: 90%
- Contagiousity: +

**10 infected; 9 dead**

**CSF**
- Prevalence: 50%
- Mortality: 25%
- Lethality: 50%
- Contagiousity: ++

**50 infected; 25 dead**
ASF - CSF - FMD

Convalescence:
- **FMD**: >90%
- **CSF**: ~50%
- **ASF**: <5%

**V. shedding** | **Viraemia** | **C. signs** | **Infectious**
---|---|---|---
Week 1 | | | |
Week 2 | | | |
Week 3... | | | |
ASF outbreaks in Latvia in 2014

Field observations
(Oļševskis et al., 2015)

12 %
69 / 585 = 0.12 (12%)
Probability of infection

Contagiousity

within a group (within stable)
high virus dose (>1000 HAU)
parenteral transmission

HIGH

between groups (open system...e.g. forest)
low virus dose (<100 HAU)
oral transmission

LOW
Summary

Endemic situation, slow spread, does not fade out

Fades out after reducing susceptibles by vaccination

Fades out spontaneously

Conatgiousity
Tenacity
Case fatality

Two of three parameters should be low/medium for the epidemic to fade out
Persistency triangle (ASF)

- Low contagiousity: only few animals get infected
- High case fatality: very few survivors & insufficient immunological protection
- High tenacity: long time survival of virus in the environment, long exposer time
Exposure opportunity

- If carcasses will be removed, exposure opportunity will decrease -> less contacts
- If carcasses will NOT be removed, exposure opportunity will increase -> more contacts
Lessons learned in recent years

- ASF is not a highly contagious disease
- ASF in WB is a habitat disease
- ASF is a “slow” disease

  - ASF did not fade out: **NO implosion**
  - ASF did not spread rapidly (Rabies-like…) **NO explosion**
  - Lethality high (>90%)
  - Starting mortality low (<5%)
  - Prevalence low (<5%)
  - Not necessarily a density dependent process

Endemic in the region, slow spread

It changed the understanding of ASF
Exposure opportunity

Marbles in motion

Contact rate +

Contact rate ++++
Passive surveillance for DP and WB

5/95 surveillance concept is not purposeful

Active surveillance gives a false sense of security
Early detection of ASF in wild boar

*Passive surveillance vs. active surveillance*

<table>
<thead>
<tr>
<th>Surveillance Type</th>
<th>Tested</th>
<th>Positive</th>
<th>% Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passive (found dead)</td>
<td>245</td>
<td>177</td>
<td>72.24</td>
</tr>
<tr>
<td>Active (hunted)</td>
<td>2765</td>
<td>40</td>
<td>1.45</td>
</tr>
</tbody>
</table>

Passive / Active: $72.24 / 1.45 = 49.82$

The probability to detect an ASF positive case is **50 times higher in dead animals than in hunted animals**

81 out of 100 positive cases are likely to be detected in dead wild boar

$(177 / 217 \times 100 = 81)$
Period during which a WB can be hunted

On the day of sampling 5 out of 100 WB (5%) are incubating ASFV. To find at least 1 positive WB 45 have to be sampled same day (95% confidence)!

(Prevalence of 2% -> 78 WB have to be sampled (1% ... 96 WB...)

5/95-Concept

Targeted diagnosis, > 4 weeks (PCR +)

<1 week (PCR +)
The epidemiological enquiry shall aim to:

a. identify the likely origin of the disease and the means of its spread;

b. calculate the likely length of time that the disease has been present *(High Risk Period)*;

c. identify establishments and epidemiological units therein, food and feed businesses or animal by–products establishments, or other locations....;

d. obtain information on the movements of animals, persons, products, vehicles, etc. which could have spread the disease agent during the relevant period preceding the notification *(High Risk Period)*;

e. obtain information on the likely spread of the disease in the surrounding environment, including the presence and distribution of disease vectors.
A) Postulate different hypothesis
B) Address each hypothesis separately
C) Exclude hypothesis one by one

Hypothesis for:

- **Way of entrance**: How (by which ways) did the pathogen entered the holding
  - *Biosecurity check*
- **HRP**: When did the pathogen entered the holding (date of entrance)
Epidemiological road map

Likely origin - way of entrance
- H1: Trade of pigs
- H2: Contact with wild boar environment
- H3: Swill, contaminated food
- H4: Others (people, vehicles, instruments...)
- H5: Vectors (ticks, insects, ???)
- H6: ...

Hypothesis

Date of entrance
- H1: <50: 1w
- H2: <150: 2-3w
- H3: >150: >4w
- H4: ...

Biosecurity check
- Hardware
  - Buildings
  - Filters
  - Fences
  - ...
- Software
  - Management
  - Awareness
  - ...

Toolbox
- Map of farm (village)
- Laboratory results
- Timeline of clinical events (Vet activities)
- Mortality /morbidity data
- Record of movements (animal, persons, vehicles, equipment...)
- Etc...
Likely origin - way of entrance

**H1:** Trade of pigs
**H2:** Contact with “wild boar”
**H3:** Swill, contaminated food
**H4:** others (vehicles, instruments…)
**H5** vectors
**H6** ...

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Biosecurity check</th>
<th>Findings</th>
<th>Likelihood</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware</td>
<td>Software</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Wild boar</strong></td>
<td>Building</td>
<td>Personnel</td>
<td>exculded</td>
</tr>
<tr>
<td></td>
<td>Fence</td>
<td>Human activities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gates</td>
<td>Management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sanitary filters</td>
<td>Work flow</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Disinfectants</td>
<td>etc</td>
<td></td>
</tr>
<tr>
<td></td>
<td>etc</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Contaminated food</strong></td>
<td></td>
<td>Swill feeding</td>
<td>+++</td>
</tr>
<tr>
<td><strong>Trade</strong></td>
<td></td>
<td>No trade</td>
<td>excluded</td>
</tr>
<tr>
<td><strong>Fomites</strong></td>
<td></td>
<td>No sanitary filters</td>
<td>++</td>
</tr>
<tr>
<td><strong>Vectors (ticks)</strong></td>
<td></td>
<td>No vectors</td>
<td>excluded</td>
</tr>
</tbody>
</table>
**Hypothesis approach: HRP**

<table>
<thead>
<tr>
<th>Farm size</th>
<th>HRP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small/back yard (&lt;50)</td>
<td>1 week</td>
</tr>
<tr>
<td>Medium/small commercial (&lt;150)</td>
<td>2-3 weeks</td>
</tr>
<tr>
<td>Large /industrial (&gt;150)</td>
<td>&gt; 4 weeks</td>
</tr>
</tbody>
</table>
High Risk Period (HRP)

Low contagiousity => low (initial) mortality
ASF remains undetected in large pig farms (below the normal mortality threshold)

HRP -> farm size
- back yard: rather short
- large farm: rather long
Farm mortality 3%/week

A: 50 pigs  
(M: <2)

B: 150 pigs  
(M: <3)

C: 1000 pigs  
(M: <30)

HRP => size of epidemiological unit
1st outbreak
breeding farm
5000 pigs

ASF

2nd outbreak
contact farm
9000 pigs

Increased mortality

13 Feb.

>25 d

7 Feb.
Biosecurity

the most effective control tool

The only potent tool we have...

- *Africa - double fencing*
- *Three golden rules of biosecurity*
Biosecurity

Hardware

Software

(Mindset/Philosophy)
**Good news (domestic pigs):** no (rapid) spread of the disease

*ASF in domestic pigs can be controlled effectively by good biosecurity!!!*

**Bad news (wild boar):** no (rapid) spread of the disease

*ASF in wild boar survives locally over months or years in wild boar populations (a habitat disease)*
**ASF control and eradication**

**Key characteristics of ASF:**
- low contagiousity, slow spread, few secondary infections
- no transmission by wind or insects,
- **site fidelity** (stable disease / habitat disease),

**Measures:**
1. Standstill
2. Culling
3. C&D

**DP: stable disease**

**Measures:**
1. Standstill (no disturbance of WB, no hunting, electrical fence, (feeding)
2. (Trapping)
3. Disposal of carcasses

**WB: habitat disease**

**Successful approach!!**

“**Virtual stable**” in forest
Risk assessment on local level (district)

Risk areas: „urban“ WB; high WB density; resting areas on highways, etc.
<table>
<thead>
<tr>
<th>Freedom of disease</th>
<th>Disease is present</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wild boar management measures</strong></td>
<td><strong>Disease control measures</strong></td>
</tr>
<tr>
<td><em>e.g.</em> population reduction to avoid agricultural damage</td>
<td><em>not wild boar management measures!!!</em></td>
</tr>
<tr>
<td><em>e.g.</em> Intensive hunting</td>
<td>Movement restriction</td>
</tr>
<tr>
<td></td>
<td>Ban of feeding</td>
</tr>
<tr>
<td></td>
<td>Prohibition of hunting</td>
</tr>
<tr>
<td></td>
<td>Intensive hunting</td>
</tr>
</tbody>
</table>

Hunting/Slaughtering  ⟷  Culling