Epidemiology of ASF in wild boar

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Tracing the origin

Georgia
June 2007
Afrikanische Schweinepest im Baltikum, Polen, Tschechien, Rumänien und Ukraine
Datenquelle: ADNS (Stand: 23.01.2018 - 09:15 Uhr) nach Feststellungsdatum
Restriktionsgebiete nach Anhang der Durchführungsbeschlüsse 2014/709/EU und 2018/11
Few certainties

Wild boar CAN ACT AS the true epidemiological reservoir of the virus;

The virus is maintained by the wild boars independently from the infection in domestic pigs and ticks

Infected Wild boar contaminate the environment making more likely secondary outbreaks in domestic pigs (non commercial and commercial farms)
How the virus spreads

Direct e contacts (nose to nose)

Contaminated environment (infected material)

Feeding infected wild boar carcasses
Virus prevalence in infected wild boar population: **1-4,5%**

Sero-prevalence in hunted WB: **0,5-2%**

**Incubation 3-5 days**

**Lethality 90-95%**

70-80% found dead wild boar are virus positive

≈ 30-50 km/year is the average speed, but the virus lasts also in old infected areas

The virus **spreads** through the **geographical continuity of the wild boar population** RATHER THAN of wild boar migration.
Monthly incidence of ASF in domestic pigs and wild boar

- January
- 2007-2012

2007-2015
Higher prevalence in summer: new born animals, insects?
Lower prevalence in winter: virus survives in carcasses
Increasing prevalence: rutting period?
Epidemiological Role played by infected carcasses and insects (no ticks)

**Maggots** could increase contacts between wild boar and infected carcasses but they have been never positive to the virus (only DNA presence but no virus): enhanced summer transmission

**Scavenging insects**: long attraction for wild boar, increased probability of direct contact with infected carcasses

**Carcasses**: virus maintenance in the environment; direct transmission to the susceptible animals
A directly transmitted virus which transmission is complicated by infected maggots, insects, and carcasses.
+ 19 wild boar approaches without contact
ASF epidemiology: the general picture

1) The virus is introduced by neighbouring infected wild boar;
2) The virus spread into the local wild boar population;
3) Infected carcasses play the role of virus maintenance in the environment even at a very low wild boar density;
4) The virus spread geographically: 30-50 km/year;
5) Due to human mistakes the virus is likely to be transported to domestic pigs or and to distant areas where the local cycle starts again in the local wild boar populations;

This pattern could even be without end!!!!
Risk of spread after introduction of the virus

- Delayed diagnosis
- Wild boar population size and density
- Forest connectivity
- Inappropriate hunting methodologies
- Lack of biosecurity measures applied during hunting
- Infected wild boar carcasses available for healthy wild boars
- Poaching
Geographical continuity

180 km

60 km
4 different groups of wild boar overlapping.....
ASF spreads for geographical contiguity
Wild boar movements: Home range: 7 km²
Hunting management
Winter feeding increases densities
Hunting and wild boar movement

Drive hunting with dogs: increase of range size during the hunting season

<table>
<thead>
<tr>
<th>Season</th>
<th>100% MCP Median</th>
<th>Q3–Q1</th>
<th>Mean</th>
<th>SE</th>
<th>95% kernel Median</th>
<th>Q3–Q1</th>
<th>Mean</th>
<th>SE</th>
<th>50% kernel Median</th>
<th>Q3–Q1</th>
<th>Mean</th>
<th>SE</th>
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<tbody>
<tr>
<td>Pre-hunting</td>
<td>80</td>
<td>104</td>
<td>88</td>
<td>25</td>
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<td>39</td>
<td>4</td>
<td>14</td>
<td>10</td>
<td>3</td>
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<td>Hunting</td>
<td>428</td>
<td>1360</td>
<td>825</td>
<td>358</td>
<td>221</td>
<td>696</td>
<td>457</td>
<td>192</td>
<td>23</td>
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<tr>
<td>Post-hunting</td>
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<td>544</td>
<td>358</td>
<td>151</td>
<td>189</td>
<td>488</td>
<td>284</td>
<td>99</td>
<td>20</td>
<td>88</td>
<td>45</td>
<td>20</td>
</tr>
</tbody>
</table>

Home range displacements during the hunting season
Wild boar long distance movements

- Daytime
- Nighttime
- Escaping hunting
- Future farrowing area

FAO data on FMD in wild boars Bulgaria
LACK OF BIOSECURITY DURING HUNTING
Inappropriate hunting
Lack of biosecurity during hunting

<table>
<thead>
<tr>
<th>Cases</th>
<th>2016 (26.10.)</th>
<th>2015</th>
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<tbody>
<tr>
<td>Hunted</td>
<td>893</td>
<td>1048</td>
</tr>
<tr>
<td>Found dead</td>
<td>447</td>
<td>422</td>
</tr>
<tr>
<td></td>
<td>446</td>
<td>626</td>
</tr>
</tbody>
</table>

Carcasses removal and wild boar density
How many wild boars?
Density dependent spread

The number of NEW INFECTED wild boar is proportional to the wild boar population size.

The duration of the epidemic is proportional to the wild boar population size.
Poland: tendency to spread within areas with wild boar density > 1 individual/km²

2014 – 30 cases
2015 – 53 cases
2016 – 28 cases
Density of wild boars (individuals per 10 km² of hunting ground) in hunting districts by hunters estimations (census) in spring 2016.
Can we define the threshold density?

The threshold density (nt) is that wild boar density at which an infectious wild boar does not encounter any susceptible wild boar in due time to spread the infection.

Duration of infectiousness
Density/availability of susceptible hosts

If the wild boar population size is decreased till a certain density, the infection fade out through a density dependent mechanism.

NO WILD BOARS = NO DISEASE
CLASSICAL SWINE FEVER in WILD BOAR

1 year persistence

1000 wild boars

ln(Epidemic Persistence in Months) vs ln(Population size)

R Sq Linear = 0.935
Apparently: not a density dependent spread
ASF in wild boar

A density dependent transmission during summer-autumn (new born and adult animals)....insects?

Virus survival during winter with few (or many) infected carcasses according to the local ecological situation

A mixed transmission: density dependent and frequency dependent => NO THRESHOLD
ASF in wild boar

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Virus survival during winter with few (or many) infected carcasses according to the local ecological situation

A mixed transmission: density dependent and frequency dependent => NO THRESHOLD
The question is:

Which is the wild boar density that prevent the contact between a susceptible wild boar with an infected carcass?

An ASF virus will overwinter in a infected carcass......3-4 months...and the virus will appear again during the late spring in alive susceptible individuals.
The question is:

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CSF: a density dependent disease

Wild boar threshold density at which ASF fade out
Through a density dependent process
ASF is not a truly density dependent infection. The final tail of the infection is determined by carcasses.
Practically

ASF in wild boar eradication is PROBABILISTIC EVENT (stochastic) NOT a DETERMINISTIC one;

Eradication probability increases when: **wild boar population size is reduced** (as much as possible); **carcasses** are safely **disposed** (as much as possible); **hunting** is carried out under **bio-security**
ASF: the virus and the environment

Since the infection is not entirely transmitted through density dependent mechanism we have to shift to

The reduction of the environmental contamination of the virus

The problem then is not purely addressed in the mechanistic reduction of the wild boar density but in reducing the viral load of the environment
Standing Group of Experts on African swine fever in the Baltic and Eastern Europe region under the GF-TADs umbrella

SGE ASF3: Moscow, Russia, 15-16 March 2016

Wild boar population reduction should be considered, in combination with other control measures, within the framework of a wild boar management strategy aimed at reducing ASF virus contamination of the environment.
EU strategy (see EFSA, 2015)

- Reduce the wild boar population size through targeted hunting of adult females
- Detection of – at least - 50% infected carcasses and their safe disposal
- Ban of winter/sustaining artificial feeding

Strategy applied - for at least - 100 km in front of the detected case

It is a medium term strategy that accepts the presence of the virus for a certain number of years
TAKE AT HOME MESSAGE

1. In ASF epidemiology, infected carcasses maintains the virus in the environment for a very long time;
2. Due to the presence of infected carcasses, there is no a minimum number of wild boar at which the virus fade out;
3. A very low number of wild boars together with infected carcasses can maintain the virus in the forest
4. Improper hunting techniques together lack of biosecurity during hunting are the most relevant factors enabling the long distance spread (jumps) of ASF virus in wild boars.
Thanks for the attention

Questions, comments?
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