Specificity of FMD surveillance in wild boars

Yanko Ivanov[1], Tsviatko Alexandrov[1], Sergei Khomenko[2], Keith Sumption[3]

[1]Bulgarian Food Safety Agency,15 A, Pencho Slaveikov, Sofia, Bulgaria; [2]FAO/EMPRES Viale delle Terme di Caracalla 00153 Rome, Italy; [3] European Commission for the Control of Foot-and-Mouth Disease, FAO, Viale delle Terme di Caracalla 00153 Rome, Italy

Open Session of the EuFMD:: OS'16
26-28 October 2016 - Cascais – Portugal
OS16-FMD-General@fao.org

Introduction

- FMD situation in Trace is additionally complicated by the lack of reliable disease surveillance and reporting in the region of the Middle East, due to political and civil conflicts.
- This highlights the need of continuous wildlife surveillance for early detection of FMD incursion, and monitoring the evolution of the infection once established.

- However the surveillance of wildlife for FMD in an open ecosystem has a number of specificities, due to:

- the unknown population parameters like: size, structure, distribution, population dynamic, type of risk factors, level of exposure, seroprevalence, virus carrier state, population immunity etc., and
- hunters level of awareness and collaboration with veterinary authority.

- The goal of this presentation is to highlight some of the strengths and weaknesses of the sampling methods employed for FMD surveillance in wild boars and to provide practical solutions to some existing surveillance issues regarding "*wildlife-livestock interface*" (the point where the two systems meet and interact).

- An EFSA modeling study on different surveillance strategies for early detection of FMD incursion in a disease free wild boar population indicates that, when the passive surveillance is based on hunting alone, the time needed to detect at least one FMD positive animal would be from 13 to 39 weeks after the virus incursion in the population, whilst, when regular sampling is implemented over the whole year, it would take about one month.

- To obtain statistically meaningful samples from wildlife populations may require dividing the target population into smaller units (e.g. groups separated by physical or environmental barriers).
- *But note that*:

- they may contain different number of animals which are not evenly distributed throughout the defined sampling units, or
- are exposed to different risk factors and levels of risk,

And this can influence the number of animals to be tested from each of the sampling units .

- One method to address the heterogeneous risk factors is to stratify the sampling units into groups with similar risk characteristics.
- For example, the wildlife populations in some municipalities may be permanently and/or directly exposed to risk of infection, due to their proximity to FMD outbreaks and greater density of deer and wild boars than the other municipalities.

The samples collection methods influence the design of the sample frame and sample size.

- Both ***opportunistic sampling***, *based on testing of road killed and found dead animals* and ***symptomatic sampling***, *based on collecting samples from "FMD sick looking" animals*, rely upon the chance that an animal will *"present itself"* for testing and on the knowledge of hunters about FMD and their involvement into the programme.
- But if FMD is not detected we cannot be sure that it is absent only because it is not present in the hunted sick looking or found dead animals.
- ***The lack of evidence is not evidence for lack of FMD !***

- ***Symptomatic sampling*** may be useful as a supplement to active collection methods or in very specific situations where the probability of detecting animals with clinical signs of FMD is high and hunters are trained and licensed for selective hunting.
- The costs per sample may be greater because only animals with clinical signs of FMD will be hunted, meaning that the disease has probably been given time to establish itself within the population.
- This method is less disruptive to the wildlife population.

Hunting as a tool of wildlife surveillance has the following limitations:

- It is practiced as a hobby, and its goal is fundamentally different from the goals of FMD surveillance;
- It takes place only in limited hunting seasons which are short;
- Hunting is prohibited in national parks, game reserves, private lands, peri-urban or protected areas; and
- Requires large sampling units to limit hunter-related bias;
- Hunted wild boars are not representative for the entire population in terms of age, sex, health status, exposure to risk because:

- Hunters often shoot animals that are closer to the roads or select certain classes of animals (e.g. trophy animals), leaving more inaccessible areas or lands where hunting is precluded.
- Furthermore, the individual hunting groups have preferred places and days for hunting.
- Hunting regulations may affect the species, age & sex of the hunted animals.
- During hunting the sample size is not controlled by the veterinary authority and rarely meet the statistical requirements in terms of detecting the presence of FMD at 5 % prevalence with 95 % confidence.

- Social and cultural factors, such as land ownership and media coverage, may influence hunters support and participation in the FMD surveillance & control programs.
- Therefore incentives for hunters to shoot unhealthy looking animals should be envisaged, if they would not be allowed to take them as trophies or consume their meat.
- The interpretation of serological results can be confounded by the maternal derived antibodies (up to 6th month of age).

- If FMD surveillance of wildlife relies only on seasonal hunting, even the number of samples is statistically significant, the probability of early detecting infected animals is very small.
- Therefore additional selective hunting for diagnostic purposes should be considered between the hunting seasons, preferably executed by sharpshooters, equipped with telescopic sight rifles. Sharpshooters may also be used to remove animals from infected areas.
- This approach is generally applied on limited areas and may be very costly in comparison with samples collected by hunters.

Samples from hunted wild animals are with poor quality because:

- Hunting is highly stressful for wild animals, especially when dogs are used. It leads to rapid hemolysis of blood samples. The risk from contamination is high, given the fact that samples are taken by hunters in improper conditions;
- The time elapsed from killing to sampling the animals after the end of hunting can last long and further deteriorate the sample quality;
- Hunting trips are most often during the holidays. Samples are usually delivered to the laboratory next days. During this time they are not stored under appropriate conditions (some tissues require to be kept frozen; others chilled, third to be fixed with formalin, alcohol etc.)

- Wild boar herds are composed by matriarchal family groups. This structure is relatively stable, but is subject to considerable dispersion during the hunting season when the home range sizes increase from 5 to 10 km towards refuge areas with less hunting pressure. The traveled distances increase with increasing the hunting pressure and return movements are observed at the end of the hunting season.
- Once introduced, the FMD virus can rapidly spreads Inside the group.
- Adult males roam over considerable distances during the mating season and can spread the virus from one group to another.

Two main sampling strategies can be applied in large areas:

- ***Unequal probability random sampling*** which includes the risk factors into the random sample (e.g. high concentration of farmed wild boars or deer herds).
- ***Adaptive cluster sampling***, that envisages a greater sampling intensity in areas where FMD positive case has been detected;

- The most reliable is to divide the infected area into several smaller areas and then calculate the sample size for each of them; or
- The whole infected area is surveyed, and the sample size is calculated at 5 % of prevalence and a confidence level at 95 %.

Example from FMD outbreaks in Bulgaria 2011/2012

- Following a case of FMD serotype O in a wild boar in Southeast of Bulgaria, in January 2011 and 11 FMD outbreaks in livestock, based on the epidemiological considerations a ***"cordon sanitaire" along the border with Turkey was established, consisting of a defined infected area (1240 km²) and two areas of risk (2160 km²).*** Within these areas a total of ***812 wild boars, 68 roe deer, 7 red deer and 2 mouflons were hunted and tested*** for FMD between Feb. 2011 and Jan. 2012.
- No FMD virus was detected, but ***seropositive animals were found in wild boars (6.9%) and roe deer (4.4%), most of them spatially clustered around the FMD outbreaks in livestock, limited within a radius of 20 km.***

- Conducting FMD surveillance activities over two or three years within a target region may offer resource and logistical advantages.
- You could conduct targeted surveillance across the whole region and at the same time randomly survey only part of it.
- ***In high-risk areas*** where FMD eradication and maintaining disease free status is the goal, ***annual surveillance is needed*** for early detection of disease occurrence (sample size at 5% prevalence and 95% confidence).
- ***In low-risk areas***, alternative collection methods may be used, such as: ***non-invasive sampling, trapping of wild boars or targeted surveillance.***

Trapping as a tool of wildlife surveillance

- ***Trapping of wild boars allows sample collection, marking of animals with GPS/GSM collars, testing for FMD by using pen-side tests and elimination of FMD-positive animals***, while FMD-negative animals do not need to be killed, which is an important factor where public opposition to such killing would be strong.
- ***Trapping may be useful in limited areas (e.g. protected areas, parks, refuges etc.).***
- Building traps requires certain level of skills and materials (about 250-300$). The ***advantage*** of such investment is that the ***traps could be used*** later ***many times for a long period.***

Non invasive sampling as a tool of wildlife surveillance

- The target animals of non invasive sampling are those attending the feeding sites, Sampling can be carried out at any time and as frequent as needed. It is cost effective and logistically simple. Swabs are incorporated into food baits (e.g. maize cobs or salt licks). Oral samples are extracted from the baits and tested by PCR for viral RNA and for identification of animal species by DNA bar-coding.
- Experimental infections of wild boars showed that FMDV could be found in saliva several days before the detection of antibodies, and was still detectable until at least 27 days post-infection, while in oral fluids of some deer species until 28 to 63 days post-infection.

Fig. 1 Bait designs Khomenko et al., 2013: 1) maize cobs with six swabs incorporated in each; 2) CSF vaccine bait used as attractant: 2a) vaccine in a blister replaced with a swab and incorporated into the bait; 2b) vaccine bait wrapped in cotton gauze and string; 2c) vaccine bait placed in plastic tubing wrapped in cotton string; 3a) and 3b) blocks of salt with holes to incorporate saliva-trapping swabs.

Wild boar attending salt lick with swab as recorded by the camera trap

Red Deer attending salt lick with swab as recorded by the

Conclusions

- Collection of samples from hunted animals is not always possible because hunting is limited in both time and space.
- Wildlife authorities and general public do not always favor the killing of wild animals for sample collection purposes;
- Samples collected by hunters are often of poor quality.
- Trapping and non invasive sampling are useful tools for wildlife surveillance and should be considered in the national disease prevention and control programmes.
- It is difficult to determine biologically meaningful borders between infected and disease free zones in an open ecosystem, which complicates the interpretation of results from the surveillance.

- The use passive wildlife surveillance for early detection of FMD is justified only when the disease is introduced in a susceptible (virgin) wildlife population, in which the morbidity & lethality rate is high and can be easily detected (e.g. availability of a lot of carcasses of wild boars and deer that can be sampled).
- In a complicated epidemic situation, the passive surveillance of wildlife should be complemented with active surveillance, supported by trapping or hunting of wild boars and deer for diagnostic purposes.

- Active sampling of wild boar for FMD is not easy. Therefore it is recommended to have in place an operational passive surveillance system throughout the year aiming to detect the introduction of the virus as early as possible.
- Hunters and gamekeepers should be instructed to report the finding of all dead wild boars and deer to the competent authority, which will take samples and carry out laboratory tests according to its evaluation of the epidemiological situation.

- Area-specific data about the wild boar population structure, hunting regime, or disease history can contribute to increase the sensitivity of a surveillance system.
- GIS-based surveillance system can contribute to better direct the efforts of FMD prevention and control measures.
- There is a recognized need for increased wildlife disease surveillance and research related to understanding the epidemiology and control of FMD.

Thank you!


OS'16
EuFMD
THE PRACTICE
OF INNOVATION
OPEN SESSION OF THE EuFMD
26 / 28 OCT 2016
CASCAIS
/ PORTUGAL
GET ON BOARD!
OS16-FMD-General@fao.org