DISINFECTION OF VEHICLES AND VILLAGE AREAS DURING FOOT-AND-MOUTH DISEASE OUTBREAKS

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ABSTRACT

Several Foot-and-mouth disease outbreaks were laboratory confirmed in Bulgaria in the beginning of 2011. In order to eradicate them, measures on a large scale took place. All actions were carried out in some specific conditions such as absence of vaccination and low temperature of environment. With regard to the concrete features, disinfection of engaged personnel, vehicles and settlements’ roads was done. The anti-epizootic measures were carried out by means of treatment with disinfectants. Biosafety and biosecurity methods and resources, new for the veterinary practice during FMD outbreak, were used.

Key words: FMD, FMDV, disinfection, outbreak.

INTRODUCTION

The Foot-and-mouth disease (FMD) is a strongly contagious acute viral disease affecting cloven-hoofed animals (Block, 2001; Zarkov, 2003; Grubman and Baxt, 2004), assumed to be the most contagious disease of mammals (OIE, 2012). On the background of delayed or inadequate control measures, the infection is transmitted exceptionally rapidly, and could spread across a continent within a week. Transmission mechanisms and spread factors are multiple (direct contact with infected animal, inhalation of contaminated aerosols, intake of infected food, water, milk, body fluids, excreta, tissues etc. (Ordinance 17/03.02.2006; Karadzhov, 2007). The quick and uncontrollable spread poses a huge risk for the appearance of uncontainable epizootics with unpredictable economic losses (Berentsen et al., 1992; Grubman and Baxt, 2004). For instance in 2001, during the FMD epizootic in the UK, more than 6.5 million of animals were killed, and the losses went over 12 billion USD (Anonymous, 2012).

Under conditions of impossibility for vaccinations, one of the primary measures for control and eradication of this especially dangerous for the global livestock industry disease is the high-quality disinfection (Steiger, 1986; Karadzhov et al., 2004; Karadzhov, 2006; Karadzhov, 2007). It could be justifiably affirmed that under modern conditions, the eradication of a FMD outbreak represents a large-scale chain of disinfection activities. When performing disinfection, it should be remembered that due to its specific structure (lack of envelope), the FMDV is distinguished with a substantial resistance both to adverse environmental conditions and to disinfectants. Under normal ambient conditions, it preserves its virulence for up to 20 days, in non-cleaned and non-disinfected barns – up to 14 days, in liquid manure – up to 40 days in the summer and 6 months in the winter, in dry faeces – up to 14 days, in the soil – up to 3 days (in the summer) etc. In acid (pH<6) and alkaline (pH>9) environments, the FMDV is rapidly inactivated.

The main option for destroying the virus in the environment is the application of disinfectants. Among them, alkalies (sodium hydroxide, hydrated lime and others) and formaldehyde-containing preparations are distinguished with their high efficacy (Barteling and Woortmeijer, 1984; McDonnell and Russell, 1999; Karadzhov, 2007). In conditions of FMD epizootic, Virkon® S turned out to be an efficient means too (Karadzhov, 2007).
MATERIALS AND METHODS

In the beginning of 2011 Foot-and-mouth disease outbreaks occurred in more than 10 settlements in Bourgas district, Bulgaria.

Restraint measures.
The restrictions of admitting vehicles to the FMD outbreak zones were strictly observed. Products of vital importance (foods, medications etc.) were offloaded in the area of the disinfection stations and further transported to the people with authorities’ transport. After laboratory confirmation of the FMD occurrence, immediate measures (sometimes even during the night) were taken for restraining the spread of the disease. The main entry and exit points to the outbreak zones were secured by warning signalization (Fig. 1) and placement of disinfection barriers.

Figure 1. Warning signalization and security at the entrance of the outbreak areas.

Creation of disinfection stations and disinfection of vehicles.
For this purpose, for the first time in Bulgaria, disinfection stations were built without affecting the road pavements, as followed: bags with sand were placed on both sides of the asphalt concrete pavement (Fig. 2). They were covered with thick polyethylene folio so that a large part of the pavement was also covered (Fig. 3). The thus formed “tray” was filled with straw and sprinkled with hydrated lime (Fig. 4). The bedding was generously soaked with 2% sodium hydroxide solution. It is known that the combination of sodium hydroxide and hydrated lime enhances the antiviral effect and contributes for longer preservation of virocidal activity. At low ambient temperatures (< 4 °C), 5% sodium chloride was added to the disinfection solution. When only cars passed through the disinfection station, the straw layer was soaked with 1.5% Virkon® S instead of sodium hydroxide (Fig. 5). The straw was always maintained well impregnated with disinfectant.
Figure 2. Constructing a board with sand bags at the sides of the disinfection stations.

Figure 3. Covering the board with polyethylene folio.

Figure 4. Treating the “tray” with hydrated lime.
To achieve the best possible disinfection effect, the speed of vehicles passing through the station was limited to 5 km/h. All vehicles, including animal-powered ones, were disinfected (Fig. 6).

Figure 5. Spraying the “tray” with 1% Virkon® S.

Figure 6. Disinfection of animal-powered vehicles.

A device for disinfection of hands with 1% Virkon® S solution was placed at an appropriate place near the disinfection station.

Disinfection of wide span vehicles used in disease outbreaks.

After being profusely washed, the wide span vehicles which took part in outbreaks control, were disinfected with 1.5% sodium hydroxide solution (Fig. 7 and 8), and the other vehicles were treated with 1.5% Virkon® S solution (Fig. 9).

Figure 7. Disinfection of a heavy excavator.

Figure 8. Disinfection of a trailer.
Disinfection in settlements.
Simultaneously with biosecurity actions, disinfection treatments of roads and endangered areas in the settlements and near to the infection focus were performed. Some novel for the country methods and preparations were applied. To achieve a better virocidal effect, surfaces were sparkleed with disinfection solution combining 1.5% sodium hydroxide and 8% hydrated lime, mixed ex tempore. As the available disinfection equipment was not fitted for such disinfection mixture, we sought the assistance of the fire and utilities services. They provided a fire & rescue vehicle as well as specialized vehicle for pumping wastewater. The provided equipment allowed for disinfection of large areas within a short period of time (Fig. 10).

The disinfection mixture was prepared in a large container, from where it was pumped into the reservoir of the machine (Fig. 11).
On the entrances of shops, post offices, restaurants, cafés and other frequently visited places, foam plastic sponges soaked with 1.5% Virkon® S were placed.

**Figure 11.** Preparing a mix of disinfectants.

**Figure 12.** Road colored in white after treating with hydrated lime.

**Disinfection of personnel.**

A special attention was paid on the personal disinfection of men who took part in any activity on the territory of the FMD outbreaks. After cleaning, boots were thoroughly disinfected by spraying with 1.5% Virkon® S (Fig. 13), as they are an important factor in the spread of FMD. The disposable clothes and personal protective equipment were burned every day after use.
RESULTS AND DISCUSSION

After analysis of the development of the epizootic, we believe that despite the encountered problems, the large-scale disinfection activities of vehicles and settlements’ areas were successful. Viral infection has not spread out of any of the outbreak zones. This is the most reliable evaluation of the effect from disinfection treatments. Taking into consideration that the workers which took part in aforementioned activities came from regions with developed livestock husbandry and the numerous wide span vehicles, current disinfections helped to overcome a huge risk. It is not accidentally that in countries with extensive livestock husbandry practices, the application of a broad spectrum of disinfection activities hold a central place in plans and strategies for control of future Foot-and-mouth disease outbreaks (Schoenbaum and Terry Disney, 2003; Kitching, 2005).

We agree completely with many authors attributing a primary importance to disinfection activities for control and eradication of the disease (Morris et al, 2002; Rweyemamu et al., 2008)

The practice for placement of a container with clean water for washing the hands after disinfection was assessed as inappropriate. To ensure the necessary exposure, disinfectant-treated hands should not be washed, but instead left to dry on their own, as we did.
Together with the good antimicrobial effect, the used disinfection mixture of hydrated lime and sodium hydroxide allowed an easy visual control on treated areas – they were colored in white (Fig. 12).

The major factors with significant effect on the activities for control and eradication of FMD infection, and disinfection activities in particular were: adverse meteorological conditions (low ambient air temperatures, snow cover) (Fig. 14), the intensive traffic, the difficult conditions for moving of the machines (the activities took place in mountainous regions – Strandzha) and the lack of time and enough trained specialist teams due to the almost simultaneous occurrences of several outbreaks.

Overcoming these challenges was achieved through great dedication, which turned into the exceptional capability of the specialists, who performed the established tasks exemplary, and the good organization throughout the conducting of the entire anti-epizootic process. This fact was highly appreciated through the granting of state honors by the mayors of the municipalities of Tsarevo and Sredets.

REFERENCES:


13. Ordinance 17 of 3 February 2006 on measures for prevention, control and eradication of foot and mouth disease in cloven-hoofed animals and the terms and conditions for their application.

