Animal biosecurity in the Mekong: future directions for research and development
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Proceedings of an international workshop held in Siem Reap, Cambodia, 10–13 August 2010

Editors: L.B. Adams, G.D. Gray and G. Murray
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ACIAR Proceedings - ISSN 1038-6920 (print), ISSN 1447-0837 (online)

ISBN 978 1 921962 25 7 (print)
ISBN 978 1 921962 26 4 (online)

Technical editing by Biotext, Canberra
Design by Clarus Design Pty Ltd, Canberra
Printing by CanPrint Communications Pty Ltd, Canberra

Cover: Children observing a serological survey and learning how the survey can improve their health and the health of the animals in their village (Takeo, Cambodia). (Photo: Domingo Caro III)
Foot-and-mouth disease (FMD) is a highly contagious viral disease that has a significant impact on the economy and livestock productivity of affected countries. We investigated the epidemiology of FMD in a potentially free (Tanintharyi) and an endemic (Sagaing) region of Burma (Myanmar). The serological study demonstrated that the prevalence of FMD in Sagaing township was very high, with an overall seroprevalence (individual level) of 42% (95% CI 38–47). However, the prevalence varied from 22% (95% CI 3–41) to 68% (95% CI 55–81) in the studied villages. All 17 villages sampled had some positive reactors in cattle to the Cedi® FMD virus (FMDV) non-structural protein (NSP) ELISA tests and it is assumed the virus is circulating within and between the villages by a variety of means. The village-level prevalence was 100%; a village was considered infected if one or more animals were positive. The possible sources of FMD in those locations were analysed using a logistic regression model and found to be associated with communal grazing, using only underground water sources, or purchasing cattle in March annually. In contrast, FMD was negatively associated with trading of cattle within the same village where the farmers possessed less than 10 cattle.

During this study a participatory method, the Modified Traditional Dutaik (MTD) meeting approach, was developed and used as a tool for disease surveillance. This method was validated against data collected from other forms of study: testing cattle with the Cedi® FMDV NSP ELISA tests, conducting questionnaire interviews, and obtaining expert opinions. Although the MTD meeting approach has some limitations, it is a powerful tool to detect FMD in Burma and is an appropriate technique to use in a country with significant financial constraints and a lack of adequate laboratory facilities. This approach can be used to collect data about the presence of FMD based on clinical signs that are characteristic of the disease as well as its epidemiology. A traditional Dutaik meeting approach was used previously as a tool for increasing public awareness in the Burma area of the Malaysia–Thailand–Myanmar (Burma) (MTM) FMD eradication zone. It is suggested that the modified approach (MTD) is suitable for use in progressive zoning for the control of FMD in Burma and can be used to actively involve farmers in the control program and to increase their awareness of the impact of FMD.

One of the objectives of this study was to support the Myanmar Zoning Working Group (MZWG) in establishing a progressive zoning approach. Since the 4th MZWG meeting in Mandalay in 2006, research findings from the current study have been submitted to this group. During this study, the status of the Sagaing zone has been modified—in the 2008 MZWG meeting, the total number of townships within the control zone was reduced from 15 to 13 to exclude two townships each with more than 100,000 cattle. In addition, it was proposed that the establishment of a progressive zoning approach should be combined with a vaccination program, taking into account the complex animal movements, large number of susceptible animals and the fact that FMD has been endemic for many years. Furthermore, this approach has been considered by others as an appropriate option for the control of FMD among South-East Asian countries. Expected international support for vaccine supply is likely to be limited, so reducing the number of susceptible animals in the control zone decreases the requirement for the number of vaccine doses. At this meeting, a buffer zone was proposed and established for future control of the disease. In endemic countries, the use of a coordinated vaccination program and zoning approach for the progressive control of FMD, in addition to other key factors such as control of animal movement and understanding the
socioeconomic impact of the disease and prevailing serotypes, must be addressed.

A partial budgeting model with Monte Carlo simulation was developed to understand the influence of FMD on the economics of animal draught power, which is the major livestock input into national agricultural enterprises. The model revealed losses to farmers were very high if outbreaks occurred every year. The findings of this study are useful for convincing farmers of the potential losses from FMD and the financial benefit in controlling the disease.

**Results**

There was more movement of livestock in the Sagaing division than in the Tanintharyi division. Livestock movements in the Sagaing division were more frequent and complex because of a favourable geographical situation and the socioeconomic situation of the local people. In contrast, the Tanintharyi division is a narrow coastal area and relies heavily on transportation by water, reducing the potential for animal movement. The major direction of cattle moving in the Sagaing division was towards the larger markets in the southern part of the division and towards China in the north because of market forces. These movement data support the decision to develop a potential FMD-free zone without vaccination in the Tanintharyi division (Myanmar MTM area). Positive samples from a serosurveillance study in 2005 in the Tanintharyi division were most likely false positive results. This was supported by findings from the MTD meetings where no evidence of clinical disease was reported by farmers in contrast to areas where the disease was endemic.

After the 2005 serosurveillance program in the Myanmar MTM area, some positive serological results were found in livestock from the Myeik township. During the 2008 study, the results from MTD meetings were combined with the results from a serosurveillance study in this region to clarify the FMD situation. The study indicated that the serological results were likely to have been false positives. All findings were submitted to the MTM Tri-State Commission meeting in Malaysia in 2008, and based on this work the commission agreed to upgrade the status of each zone within the Myanmar MTM zone. This meant that the control zone progressed to an eradication zone, the buffer to a control zone and the infected zone to a buffer zone. To achieve the target of the free zone without vaccination recommended by the World Organisation for Animal Health, it is necessary to do more detailed studies in Kawthoung and Myeik districts, including putting recording processes in place to control animal movements.

**Discussion**

There were many time and financial constraints for this study. The Cedi® FMDV NSP ELISA test could be used only to validate the MTD meeting approach in the Sagaing and Myeik township areas. Other laboratory results were obtained from the National FMD Laboratory and serotypes associated with outbreaks were obtained from the South-East Asia Foot-and-Mouth Disease Campaign (SEAFMD) website. The field trip in the Sagaing division was conducted within a limited time frame because the accompanying staff from the Livestock Breeding and Veterinary Department had other work to do and some villages had no accommodation or electricity. As a consequence, it was not possible to collect all data and some bias may have been introduced. For example, in Ngatayaw village, the questionnaire interviews were not administered and sera were collected by convenience sampling as opposed to the random sampling that was used elsewhere. Similar constraints were encountered in the study in Myeik township because of security and accommodation difficulties. The use of a local dialect also posed challenges, resulting in the MTD meetings in Myeik being slower than those in the Sagaing division. These reflect the difficulties of conducting research in the real world.

This study has further demonstrated that FMD is an important disease of cattle in Burma and financial loss from this disease has previously been underestimated. With the current situation in the country and the existing veterinary infrastructure, the use of a zoning approach with a strategic vaccination program is suitable for the effective control of the disease. This is because FMD has been endemic within the country for many years and financial and technical constraints in controlling disease still exist. Control and eradication of the disease across the whole country is not feasible at the moment given the existing veterinary infrastructure; however, it is feasible to establish a progressive zoning approach for the control of FMD in the Myanmar MTM area without vaccination and in the Sagaing division with vaccination. The control of FMD within the country will have significant benefits not only for individual farmers, but also for the economy of the country and consequently the majority of the Burmese population.