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Reemergence of Foot and Mouth Disease in Andaman and Nicobar Islands, India

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ABSTRACT

Foot-and-mouth disease (FMD) is an acute highly contagious viral disease of cloven-hoofed animals which has been discovered more than 100 years ago. The causative organism is a RNA virus belongs to the Aphthovirus genus, Picornaviridae family. The disease is endemic in India and every year the economic loss due to direct and indirect cause is more than USD 4 billion annually. The Andaman & Nicobar Islands also suffered due to the outbreak of FMD in the year 2005 which was due to serotype O. However, in the present study the reemergence of FMD virus almost after a gap of 13 years has been reported from the South Andaman district of the A & N Islands. The outbreak was confirmed as serotype O and is mainly affected more than 800 cattle, goat and buffalo population. The reemergence of the FMD virus in the islands has posed a serious concern to the livestock of this island which is now being considered as almost free from many of the dreaded disease. Based on the epidemiological investigation it could be concluded that the virus might have entered through the transport of straws which is being used as packing materials for vegetable and fruits from mainland.

Keywords: A & N Islands, Foot and Mouth disease, Outbreak, Reemergence

Foot and mouth disease (FMD) is a highly contagious disease of cloven hoofed animals including cattle, sheep, goat and pigs (Racaniello, 2001). This disease is endemic in India and producing heavy economic losses to the tune of more than 4 billion US dollars per year (Venkataramanan *et al.,* 2006). In India, the disease is mainly caused by serotypes O, A and Asia-1. Among the serotypes, type O is the most prevalent one and accounts for 83-93% of the outbreaks followed by Asia 1 (3-10%) and A (3-6.5%). Serotype C has not been reported in the country since 1995 (Biswal *et al.,* 2012). The outbreak of FMD has also been reported from Andaman & Nicobar Islands (Hemadri *et al.,* 2006; Sunder *et al.,* 2008). FMD control programme was launched in this islands with mass vaccination of the all the animals of the South Andaman since 2005. Since then 22nd round of vaccination have been completed covering all the animals in the South Andaman. The regular six monthly vaccinations of the animals and through implementation of control programme the outbreak of FMD could be controlled and since then no incidence of FMD has been reported from this islands (Sunder *et al*., 2014; Sunder *et al.,* 2015). However, the recent trend of the post vaccination antibody titer in the vaccinated animals found to be reducing which has created an alarming situation. Generally the island is considered to be free from most of the dreaded diseases of livestock and poultry, except the outbreaks of Swine fever and FMD, the island has not reported any outbreak of livestock disease (Sunder *et al.,* 2015). However, the recent outbreak of FMD in this island has posed a serious concern to the livestock of this island.

MATERIALS AND METHODS

Present outbreak of Foot and Mouth disease (FMD) was reported in the cattle, buffalo and goats of South Andaman Islands during May to June 2018 (Fig. 1). The disease was first reported in the cross-bred cattle showing typical

lesion and symptoms of FMD characterized by high temperature, salivation, frothing, eruption of vesicle on the gums, tongue and hoof lesions (Fig. 2). Consequent to the development of lesions in the cattle, all the other cattle of the same herd (30 no.) were infected and showed typical FMD symptoms. Later the disease was spread to the adjoining areas and villages affecting large number of cattle, buffalo and goats. Gradually the disease spread to other parts of the South Andaman villages in the radius of approximately 35 km zone. Then in due course of 2 to 3 months the disease spread to other tehsils (Ferrargunj), where the population of cattle was more concentrated.

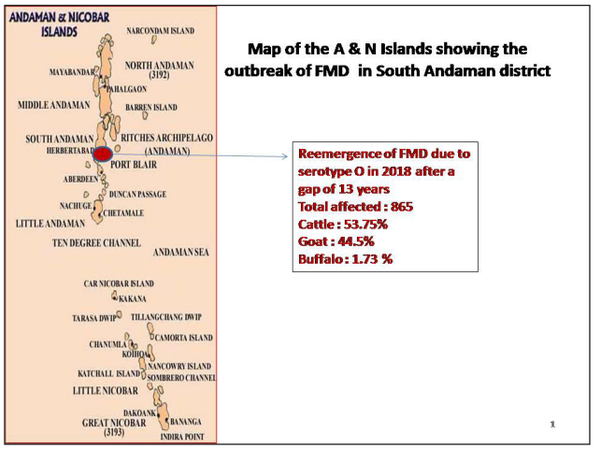


Fig. 1: Map of the island showing the outbreak of FMD in 2018 in South Andaman

Fig. 2: Foot and mouth lesions observed in the affected cattle

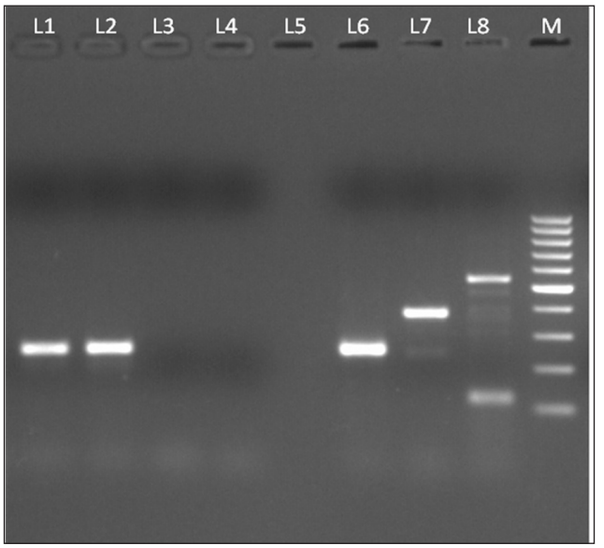
In the present outbreak a total of 465 cattle, 15 buffaloes and 385 goats were affected due to FMD. The morbidity was found to be 85 to 90%, however, the mortality was found to be less than 2%. The spread of the disease to the adjoining villages did not show any systematic pattern. However, the spread was random and at the same time the disease was reported from different areas of the South Andaman district. Similar to the trend of last outbreak, this time also the outbreak was first reported from the Port Blair city. Due to the geographical isolation and separation the outbreak was confined to only South Andaman district. The movement of the animals in this island is generally from North and Middle Andaman to South Andaman, which might be the reason for confinement of the disease in the South Andaman district only.

A total of twelve clinical samples (tongue epithelium) and 18 sera samples were collected from the cattle showing the typical symptoms of FMD. The samples were transported to Directorate of Foot and Mouth Disease, Mukteswar for confirmatory diagnosis and serotyping of the FMD virus. The serotype specific antigen detection was carried out by using type-specific double-antibody sandwich ELISA, where serotype-specific polyclonal antibodies from rabbit and guinea-pig are employed as trapping antibody and detecting antibody respectively for diagnosis (Roeder *et al*., 1987). The samples were also processed for multiplex PCR as described by the Giridharan *et al.,* 2005. The total RNA was extracted from field samples by total RNA isolation kit (Quiagen) as per usage guidelines. Complementary DNA (cDNA) was done by using AMV reverse transcriptase (Promega) and oligo dT primer. The serotype specific detection of FMDV was done by multiplex PCR described earlier by Giridharan *et al*., 2005 along with respective PCR controls. The amplified products were analysed on 2% agarose gel and visualized by ethidium bromide staining.

RESULTS AND DISCUSSION

Based on the laboratory confirmation by sandwich ELISA and mPCR, out of 12 clinical samples four samples showed positive and was confirmed as serotype O. The samples were examined by sandwich ELISA and PCR assays and confirmed as serotype O (Fig. 3). Serotype O is the most prevalent of the seven serotypes of foot-and-mouth disease (FMD) virus and occurs in many parts of the world (Di Nardo *et al.,* 2011; Sobrino *et al.,* 2001; Pattanaik *et al.,* 2012). The severity of the outbreak has been found to be very high with typical lesion and symptoms of FMD. The last outbreak which was reported in the 2005 was due to the serotype O (Hemadri *et al.,* 2005; Sunder *et al.,* 2008). The present outbreak has also been found to be due to serotype O. The reemergence of FMD has also been

reported in other countries (Baipoledi *et al.,* 2004; Park *et al.,* 2014).



Lane 1 positive sample type O
lane 2 positive sample type O
lane 3 negative sample
lane 4 negative sample
lane 5 pcr control (no template)
lane 6 positive control type O (~250 bp)
lane 7 positive control type A (~400 bp)
lane 8 positive control type XI (~1100 bp)

Fig. 3: mPCR showing the positive sample (Serotype O)

The reemergence of the FMD in this island almost after a gap of 13 years has again pose serious threat to the disease free environment of the islands. Since the last outbreak due to serotype O, the FMD control programme has been implemented in this island with half yearly vaccination. Till date 22 round of vaccination have been completed. The sero-protective antibody titre during the last ten year shows that initially the vaccinal antibody response was found to be considerably high with sero-protective antibody tire ranged from 13.8% to 63.5% (Sunder *et al.,* 2015). However, since last three rounds of FMD vaccination the protective antibody titre ranged from 30-50% only which indicated that the herd immunity is not sufficient to protect the animals from the outbreak of FMD. The sero-monitoring of the random animals showed that there has been gradual reduction in the number of animals which showed positive to 3rAB3 antibodies which suggested that the virus is not in circulation. The percentage of the animal with DIVA positive decreased from 10% to less than 2 % during the last ten years. In spite of the reduction in the DIVA positive animals, the outbreak of FMD has been reported from this island after a gap of 13 years.

The recent outbreak of the FMD due to serotype O might be due to the reasons that the protective antibody titer was found to be less than 50 % which is not sufficient to provide protective herd immunity. The herd immunity during the year of FMD outbreak was found to be only 41% (Type O), 38% (Type A) and 44% (Type Asia-1) respectively (Fig. 4). The level of poor vaccinal antibody titer might have aggravated the conditions and exposed the animals to FMDV. During the last 15 years there has not been any transport of animals from mainland to islands. Therefore the reasons for the present outbreak might be due to the entry of virus from the mainland through packing materials/paddy straws which are being used as packing materials for transport of vegetable and fruits. The disease pattern of the present outbreak also shows that the first case was reported from the Port Blair city, wherein the stray cattle might have eaten the contaminated paddy straws and exposed to the virus. The import of meat products and meat from mainland India cannot be ruled out in playing a role in import of the virus from the mainland.

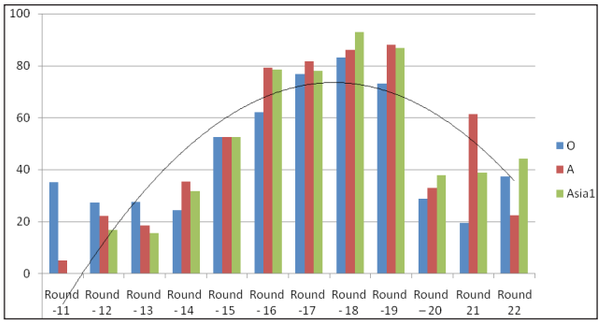


Fig. 4: Trend of post vaccinal antibody titer in cattle of South Andaman

The severity of the infection in the cattle has been observed to be very high than the goats. Similar to the last outbreak pattern, wherein more than 500 cattle, goat, pig and buffalo were affected, in the present outbreak also more than 800 livestock were affected. The attack rate of the present outbreak was calculated to be 8.03% with economic loss of ₹ 17.94 lakhs. The present outbreak is the

third outbreak reported from the islands. The first outbreak was reported in the year 1981-82 and the second outbreak was reported in 2005 (Sunder *et al.,* 2008) Compared to the earlier outbreak the present outbreak spread in large area with large population of livestock were affected. The present outbreak is also due to serotype O which is also been reported mainly from other parts of the country. In the present outbreak cattle, goat and buffalo were affected. There are reports available wherein the FMD outbreak has been remerged even after a gap of 15 years in South Korea which was correlated with the outbreak of FMD due to type O in other south East Asian countries (Park *et al.,* 2014). International trade and globalization are indicated as one of the main factors in transmission of infectious diseases in livestock and poultry. The reemergence of the FMD due to serotype O in these islands after a gap of 13 years may be due to the import of livestock products and indirect transmission of the FMD virus through paddy straws, however the epidemiology of the transmission is yet to be established. Although the island is surrounded by sea and is geographically isolated and separated from mainland by almost 1400 km, the direct contact transmission of the FMD virus is least possible. Reports are also available which suggested that the indirect transmission of FMD virus due to hay and other materials have been reported (Sakamoto and Yoshida, 2002; Park *et al.,* 2013; Shin *et al.,* 2003). Although there is no confirmation about the transmission of the virus from mainland, however based on the epidemiology of the disease outbreak it could be concluded that the probably the virus might have come through the straws which is being used as packing materials for transport of vegetables and fruits. Like previous outbreak which was reported during 2005, the centre of the present outbreak was also found to be in the same region *i.e.* Port Blair city area.

In era of globalization, FMD control attains an important priority as chances of disease threat have been increased many folds due to open trade between countries within a particular continent. The continuous occurrence of FMD in developing countries may be mainly attributed to the poor socio-economic conditions; movement of live infected animals, followed by trade in animal products constitutes the greatest risk for spread of foot and mouth disease virus (FMDV). Further, continuous evolution of FMDV gives rise to new strains that cause periodic upsurges in the number of cases and thus increase the risk of spread into new areas.

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CONCLUSION

It may be concluded that the reemergence of foot and mouth diseases outbreak in Andaman and Nicobar Islands is a serious concern and strict quarantine and bio-security measures are required to be undertaken to make the island disease free.

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