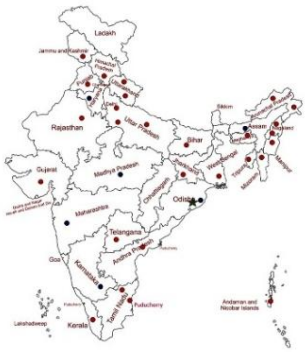

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ICAR - National Institute on Foot and Mouth Disease

FMD Case Study Series-2025

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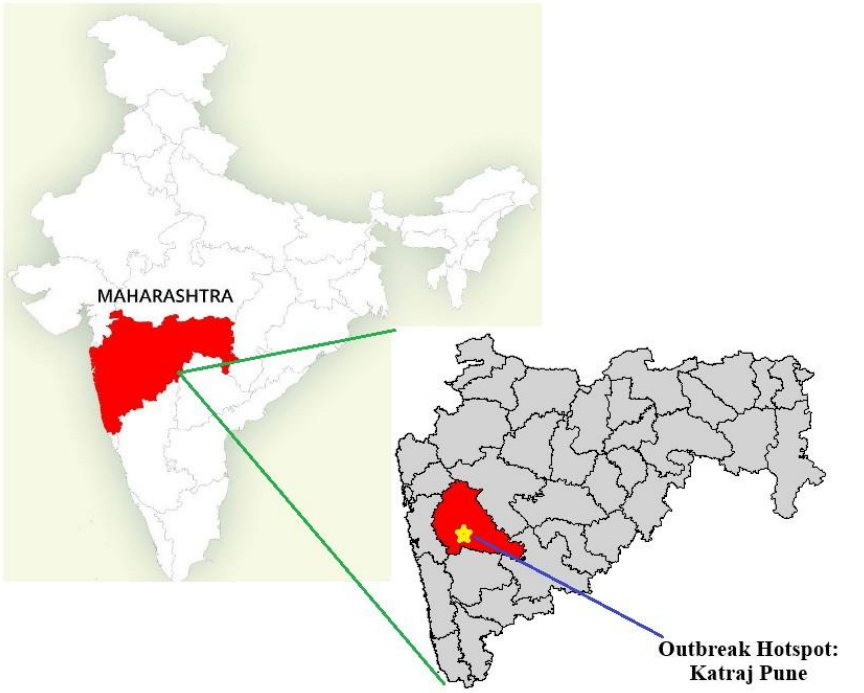
Case Study Number:		**5/2025**
State involved:		Maharashtra
Area/District:		Rajiv Gandhi Zoological Park and Wildlife Research Centre, Katraj, Pune
Month/Year:		March/2025
Primary Species affected:		Spotted Deer (*Axis axis*)

FMD in spotted deer *(Axis axis)* in Rajiv Gandhi Zoological Park and Wildlife Research Centre, Pune, Maharashtra



Tongue lesions in dead spotted deer

Case History: An episode of disease was observed in the captive wild ungulate population of the Rajiv Gandhi Zoological Park and Wildlife Research Centre, Katraj, Pune – 46, Maharashtra. The investigation began on 29th July, 2025. The village of Katraj, which falls under the Pune Municipal Corporation, has approximately 5,361 households. The zoo maintains its own breeding population of wild ungulates, and in the vicinity, there are two Goshalas collectively housing 642 animals. Routine FMD vaccination is generally not practised in the zoo, although livestock vaccination in the surrounding region was completed during February–March 2025, covering about 8735 animals (approximately 90% of the population). As per the recommendations of the zoo's Health Advisory Committee, FMD vaccination had been initiated in Indian Gaur/Bison, Nilgai and Chaushinga before the episode. FMD–susceptible captive animals totalled 174, comprising 80 spotted deer, 35 blackbuck, 22 sambar, 15 barking deer, 13 Chausinga (four-horned antelope), 6 Nilgai, 2 Bison and 1 Chinkara. Mortality in the spotted deer (*Axis axis*) enclosure began on June 7, 2025, with no apparent clinical signs. Carcasses were submitted to WRDDL, Pune, on 08th July, 2025, for post-mortem examination and sample collection. On 09th July, 2025, classical symptoms suggestive of FMD — salivation, lameness, vesicles on the tongue, and interdigital reddening — were observed. The entire herd of spotted deer remained anorectic for 3–4 days

around 10–11th July, 2025. Between 06th and 17th July, a total of 18 spotted deer died. Along with FMD-like illness, some samples also tested positive for *Pasteurella multocida* and *Clostridium perfringens*, while nitrate contamination was detected in fodder and water; MPN counts were above permissible limits, indicating a multifactorial mortality pattern, with FMD acting as the primary disease trigger and concurrent bacterial infections and nitrate contamination contributing to severity and mortality.

Field Investigation and Epidemiology: Diagnostic samples were sent to WRDDL, Pune; ICAR-NIFMD, Bhubaneswar; NISHAD, Bhopal; and IVRI, Bareilly. Initial sandwich ELISA testing at WRDDL was negative for FMD. Samples dispatched to ICAR-NIFMD on 12th July, 2025, were received on 18th July, 2025, but were unfit for testing. Fresh tissue samples were again sent by special messenger and received at ICAR-NIFMD on 22nd July, 2025. These samples were confirmed positive for FMDV serotype O on 24th July, 2025, through serotyping ELISA and molecular assays. A meeting of the Health Advisory Committee of the Katraj Zoo was held on 25th July, 2025, under the chairmanship of the Associate Dean, KNPVC, Shirwal, to formulate control and containment measures. Sections of the zoo housing susceptible animals were temporarily closed to visitors, and biosecurity measures were intensified. On 29th July, 2025, the Response and Outbreak Investigation Team (ROIT) visited the zoo to assess the outbreak situation. At the time of the visit, the affected animals were alert, active and had regained normal feeding behaviour. However, two animals in the infected enclosure and two sambar deer in a nearby enclosure were still showing lameness, consistent with post-FMD complications. Environmental samples—including soil, faeces, fodder, drinking water, soil near vehicle parking areas and drainage water—were collected. All samples tested negative for FMDV by RT-qPCR on 31st July, 2025, indicating the absence of detectable active environmental contamination at the time of investigation. Based on epidemiological assessment, potential routes of virus introduction included indirect transmission via visitors, fomites associated with feed and fodder transport vehicles, and the movement of animal attendants across enclosures without adequate biosecurity measures. It was noted that biosecurity measures within the zoo were poorly implemented, which may have facilitated the introduction and spread of the FMD virus within the captive herbivore population.

Laboratory Diagnosis: For confirmation of FMD virus involvement, multiple diagnostic laboratories were engaged. WRDDL, Pune, conducted initial testing, which was negative. ICAR-NIFMD, Bhubaneswar, received the first consignment of samples on 18th July, 2025, but these were unsuitable for testing. Fresh samples dispatched by special messenger were received on 22nd July, 2025 and subjected immediately to FMDV serotyping ELISA and molecular testing. On 24th July, 2025, FMDV serotype O was confirmed. On 29th July, 2025, ROIT collected environmental samples from infected and surrounding areas, including soil, faeces, feed, drinking water, vehicle parking zones and drainage water. All samples tested negative for FMDV by RT-qPCR on 31st July, 2025.

Socioeconomics of FMD Outbreak: Although the affected animals belonged to captive wildlife rather than livestock, the outbreak carried significant implications for animal conservation, zoo operations, biosecurity management and public interface. The zoo attracts large numbers of visitors, increasing the potential risk of pathogen introduction. Two large Goshalas located nearby (642 animals) constituted an at-risk livestock population, though no spill-over was reported. Early containment measures, enhanced biosecurity, rapid laboratory confirmation and temporary restriction of visitor access prevented further spread of FMD within the zoo and minimised the risk of dissemination to surrounding livestock populations. The broader socioeconomic impact included disruption of zoo activities, redirection of veterinary resources, and heightened public health concern. The coordinated efforts of the zoo administration, State Animal Husbandry Department and ICAR-NIFMD successfully contained the outbreak and restored normal functioning, as indicated by the recovery of feeding behaviour and the absence of environmental contamination by the end of July 2025.

Control Measures for FMD Outbreak with Other Infectious Diseases in a Zoological Park

1. Immediate Response and Incident Management

- **There must be a ready Zoo Emergency Disease Response Plan** with an **Incident Command Team** (e.g., Director, Veterinarian, Biosecurity Officer, Communications lead).
- **Suspend animal movements immediately**—no shifting between enclosures, no off-display movement.
- **Restrict entry/exit of staff and vehicles** until risk assessment is completed.
- **Notify authorities**: State AH Dept., district veterinary office, and central zoo authority if required.

2. Segregation and Isolation

A. Isolation of Suspected / Affected Animals

- Move clinically affected animals to **designated isolation units** away from cloven-hoofed species or any other susceptible species.
- Separate animals by disease category:
  - FMD-suspected / FMD-confirmed
  - Other infectious disease suspects (e.g., respiratory, enteric, zoonotic)
  - Healthy but exposed animals

B. Species-specific Considerations

- **Cloven-hoofed animals** (bovids, cervids, suids)—highest risk; strictest quarantine.
- **Carnivores**, **primates**, **avians**—separate quarantine spaces depending on concurrent diseases.

3. Movement Control, Zoning & Access Restrictions

- Divide the zoo into **Red (Infected), Amber (Exposed), and Green (Clean) zones**.
- Create **dedicated staff teams** for each zone; no cross-over allowed.
- **Footbaths**, disinfectant mats, and sprayers at all entry/exit points.
- Prohibit visitor entry into high-risk zones; if necessary, temporarily **close the zoo** to the public.

4. Diagnostic Testing and Surveillance

Foot-and-Mouth Disease:

- Collect **oropharyngeal swabs, serum, and vesicular epithelium** for FMDV PCR and antibody ELISA.
- Test all cloven-hoofed animals, including asymptomatic contacts.

Other Infectious Diseases (Depending on symptoms: respiratory, enteric, and neurological)

- **Bacterial culture**, **viral PCR panels**, **parasitological exam**.
- Daily **morbidity and mortality line listing**.
- **Twice-daily clinical rounds** for early detection.

5. Treatment & Supportive Care

- **FMD**: Supportive therapy—NSAIDs, vitamins, wound care for ulcers, fluid therapy, soft diet.
- Treat concurrent diseases with **targeted antimicrobials/antivirals** based on test results.
- For endangered species, consider **intensive care units** and **separate team allocation**.

6. Biosecurity and Sanitation

- **Strict PPE**: disposable coveralls, gloves, N95 mask, boots.
- **Disinfection protocol** using:
  - Sodium hypochlorite 2%
  - Potassium permanganate footbaths
  - Virucidal disinfectants effective for FMDV (e.g., citric acid 1%, NaOH 2%)
- Clean **feeding equipment, water troughs, and transport crates** separately for each zone.
- No feeding of raw meat or animal byproducts that may be contaminated.

7. Control of Vectors and Wildlife Movement

- Rodent, bird, and stray animal control to prevent mechanical spread.
- Prevent entry of **feral cattle, buffaloes, goats, or wild ungulates** near the zoo perimeter.

8. Vaccination Strategy

- **Emergency ring vaccination** of susceptible cloven-hoofed animals within the zoo.
- Vaccinate perimeter livestock (local municipal animals, nearby farms) through coordination with local veterinary authorities.
- For other diseases (e.g., HS, BQ, rabies), implement **catch-up vaccination** once the outbreak stabilises—only after clearing exposed individuals.

9. Waste Management

- Dispose of feed waste, bedding material, and manure from infected zones separately.
- Incinerate or deep-bury (as per CPCB guidelines) carcasses of affected animals.
- Disinfect drainage lines and water run-offs from infected enclosures.

10. Staff Management

- Train all staff in **clinical signs of FMD and other diseases**, biosecurity steps, zoonotic risk.
- Maintain **daily staff health log**—if any concurrent zoonotic disease is suspected (influenza, TB, salmonellosis), ensure medical screening.

11. Visitor Communication & Public Relations

- Transparent communication:
  - State that the zoo is taking precautionary disease-control measures.
  - Avoid naming specific animals unless required.
- If closure is needed, provide **anticipated reopening timelines**.

12. Post-Outbreak Measures & Recovery

- **Minimum 30-day observation** after the last new FMD case.
- Conduct full **terminal disinfection** of affected premises.
- Review and update:
  - Zoo Biosecurity SOPs
  - Quarantine protocols for incoming animals
- Reassess enclosure layout and interspecies proximity for risk reduction.

13. Preventive Strategies for Future

- Mandatory **30-day quarantine** for all new animal arrivals.
- Annual vaccination schedule for susceptible species.
- Routine surveillance including:
  - Quarterly FMD seromonitoring.
  - Regular screening for common zoo pathogens.
- Maintain stock of **PPE, disinfectants, outbreak kits**, and isolation infrastructure.

Conclusion: The present investigation documents an outbreak of foot-and-mouth disease in captive wild ungulates at the Rajiv Gandhi Zoological Park and Wildlife Research Centre, Pune, Maharashtra, during June–July 2025. The outbreak primarily affected spotted deer, with confirmation of FMD virus serotype O by ICAR–NIFMD, Bhubaneswar. Timely epidemiological investigation, laboratory confirmation, and coordinated response by the zoo authorities, State Animal Husbandry Department, and ICAR institutions enabled rapid implementation of containment and biosecurity measures. Temporary restriction of animal movement and visitor access, enhanced sanitation, and strict biosecurity practices effectively prevented further spread of infection within the zoo and spill-over to nearby livestock populations. The absence of detectable FMD virus in environmental samples towards the end of the outbreak period further indicated successful containment. This case highlights the vulnerability of captive wildlife populations to transboundary animal diseases such as FMD, particularly in settings with high human–animal interface and suboptimal biosecurity. The findings underscore the importance of regular risk-based surveillance, strict biosecurity protocols, and preparedness plans for zoological parks to prevent introduction and amplification of FMD and other infectious diseases. Strengthening intersectoral coordination and adherence to preventive strategies will be critical for safeguarding wildlife health, conservation efforts, and surrounding livestock populations.