# Differential Diagnosis of Nodular Skin Lesion in Bali Cattle: A Surveillance Case Study from Keerom District, Papua Province, Indonesia

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**Summary**

This study details a clinical field investigation of nodular skin lesions in Bali cattle in Keerom District, Papua Province, Indonesia, conducted in January 2025 to differentiate endemic conditions from high-priority diseases like Lumpy Skin Disease (LSD) and Foot and Mouth Disease (FMD). Using an active case-finding approach and laboratory analysis at DIC Jayapura, the investigation focused on a closed herd where 33.3% of animals exhibited firm multifocal nodules. Despite physical similarities to LSD, the affected cattle remained systemically stable, and diagnostic testing—including RT-PCR and ELISA—was negative for LSDV and FMDV, while microscopic evaluation confirmed a *Demodex* sp. infestation. These findings highlight the importance of diagnostic precision in strategic border regions to prevent economic alarm and ensure evidence-based biosecurity protocols.

**Introductions**

Nodular skin lesions are critical for differentiating endemic conditions from National Strategic Contagious Diseases (PHMS) such as Lumpy Skin Disease (LSD) and Foot and Mouth Disease (FMD). While LSD typically presents with generalized nodules (0.5–5 cm) that undergo central necrosis, and FMD is characterized by oral and pedal vesicles, bovine demodicosis manifests as firm, localized nodules associated with the hair follicles (1, 2, 3). These *Demodex sp*. nodules, predominantly found on the head, neck, and shoulders, serve as key clinical indicators for distinguishing this parasitic infestation from highly contagious viral pathogens (4).

Bovine demodicosis is a widely distributed parasitic disease with prevalence rates ranging from 4.9% in Ethiopia to 43.5% in Russia (4, 5). In Indonesia, this condition has been documented in Bali cattle (*Bos javanicus*) across various regions, including reports from Badung District, Bali Province, in 2014 and more recently in Gowa District, South Sulawesi Province, in 2023, where one in three cattle was found infested (1, 6). The recurring presence of this parasite across the archipelago underscores the necessity for continuous monitoring and its inclusion as a primary differential diagnosis for nodular skin diseases.

Geographically, Keerom District is a strategic border region that serves as a critical point for national animal health surveillance. Amidst the widespread outbreaks of Lumpy Skin Disease (LSD) and Foot and Mouth Disease (FMD) across Indonesia, Keerom District position as a cross-border gateway increases the risk of introducing transboundary animal diseases. The tropical climate, characterized by high humidity and abundant insect vectors, creates an ideal ecosystem for mechanical virus transmission, which can be clinically difficult to distinguish from endemic diseases such as demodicosis (2, 3). The emergence of nodular skin lesions in this border area demands high vigilance and accurate differential diagnosis to prevent significant economic impacts and safeguard the national animal health status. Consequently, precise clinical and laboratory evaluation of these manifestations is essential for implementing appropriate biosecurity and therapeutic protocols.

**Methods**

The investigation was conducted in Wulukubun Village, Skanto Subdistrict, Keerom District, Papua Province, Indonesia, from December 1, 2024 to January 31, 2025. To verify the case in cattle, an active case-finding approach using a defined case definition was applied. Cases were classified as suspected or confirmed. A suspected case was defined as cattle with Multiple nodules with or without folliculitis and furunculosis of skin lesion in the face, neck and shoulders, occurring in Wulukubun Village between December 1, 2024 and January 31, 2025. A confirmed case was defined as a suspected case with laboratory confirmation through ectoparasite identification.

To describe the case characteristics, field data were gathered through direct clinical observations of the animals and farm conditions conducted on the visited farms and Face-to-face structured interviews with the cattle farmer. An investigation form used that captured details such as farmer's name and location, timeline, incidence, affected animals and clinical signs, and potential risk factors.

Animal samples were collected from a farm managing six Bali cattle (*Bos javanicus*), two of which exhibited clinical manifestations. Sampling procedures included the collection of whole blood with EDTA, serum, nasopharyngeal swabs, and skin scrapings from the nodular lesions. Diagnostic tests were performed at the DIC Jayapura, comprising molecular detection using Real-Time PCR (RT-PCR) for Foot-and-Mouth Disease Virus (FMDV) from two nasopharyngeal swabs, and Lumpy Skin Disease Virus (LSDV) from two whole blood samples and one skin scraping. Serological analysis for LSD antibody detection was performed on two serum samples using ELISA. For ectoparasite identification, two skin scrapings were obtained from each symptomatic animal; processed with 10% Potassium Hydroxide (KOH), and the samples were placed on glass slides for direct microscopic examination. Data were analysed using descriptive and simple analytical methods to characterize the clinical presentation and correlate field findings with laboratory confirmatory results.

**Results**

*Descriptive Finding*

The cutaneous condition progressed over a two-month period prior to the formal investigation. The index case, identified by the farmer on December 1, 2024, initially presented with minor cutaneous discoloration. A secondary case occurred on January 1, 2025, suggesting a slow and progressive intra-herd transmission. On January 14, 2025, the incident was officially reported to the Keerom District animal health officer at Keerom District Agricultural Office, prompting an initial administration of multivitamin therapy and formal notification to the DIC Jayapura. The comprehensive veterinary investigation and diagnostic sampling were subsequently conducted on January 15, 2025.

The investigation was localized to a smallholder farm in Wulukubun Village, Skanto Subdistrict, Keerom District, Papua Province, Indonesia. This region is characterized by high tropical humidity and a significant population of biting insects. The facility functioned as a closed-herd system; the affected cattle were born and raised on-site with no history of movement or introduction of new animals from outside Wulukubun Village for the duration of their lives. The spatial risk was confined to a single communal enclosure where all six cattle were housed, facilitating close physical contact.

Physical examination of the six Bali cattle (*Bos javanicus*) revealed that two of six cattles (33.3% of the herd) exhibited multifocal cutaneous nodules. The index case is a 2-year-old female cattle, and the secondary case is a male cattle aged under 1 year. The lesions were primarily localized on the facial region, neck, and abdomen. These nodules were characterized by a firm consistency upon palpation (induration) and lacked the central depression typical of necrotic LSD lesions.

The diameter of the nodule lesions varied significantly, ranging from 2 cm to 8 cm. Cutaneous nodules in the secondary case were less severe than those in the index case, with lesion sizes characterizing a 'dollar plaque' appearance. Chronic progression was evident, with the index case showing extensive skin thickening and localized alopecia (hair loss) around the nodular sites. Despite the severity of the cutaneous manifestations, both affected cattle remained systemic-physiologically stable, maintaining a normal rectal temperature, consistent appetite, and active behavioural patterns. No mucosal lesions or lymph node enlargements were observed during the clinical workup.

*Laboratory and Diagnostic Findings*

The diagnostic results from the DIC Jayapura provided definitive evidence for the exclusion of transboundary viral pathogens (FMDV and LSDV) and the confirmation of parasitic infestation (*Demodex sp.* mite) shown in Table 1.

Nucleic acid extraction from whole blood with EDTA, nasopharyngeal swabs, and skin scrapings yielded negative results for the *Capripoxvirus* (LSDV) genome via RT-PCR. Furthermore, all samples tested negative for Foot-and-Mouth Disease Virus (FMDV), effectively ruling out primary differential diagnoses of national strategic concern. Complementing the molecular results, ELISA for LSD antibody detection was also negative, indicating a no of prior exposure or immune response to the *Capripoxvirus*in the sampled cattles.

Figure 3. *Demodex sp.* adult mite isolated from skin scrapings, observed under light microscopy (400x magnification)
Microscopic examination of deep skin scrapings, processed with 10% Potassium Hydroxide (KOH), revealed a high density of *Demodex sp.* mites across various life stages, including adults and nymphs. The presence of these mites within the hair follicles was highly consistent with the chronic nodular dermatitis observed during the field investigation.

*Action Taken*

Immediate medical intervention was implemented on January 14, 2025, through the administration of Ivermectin to eradicate the *Demodex* sp. infestation, with a follow-up dose scheduled for January 28, 2025. In addition to antiparasitic therapy, the farmer was provided with disinfectants and anthelmintics to enhance overall stall hygiene and herd health. The investigation team also conducted Communication, Information, and Education (CIE) sessions focusing on biosecurity protocols and the clinical recognition of National Strategic Contagious Diseases (PHMS). As a precautionary measure against intra-herd transmission, the owner was instructed to maintain the isolation of symptomatic animals while awaiting definitive laboratory confirmation.

**Discussion**

The clinical manifestation of multifocal cutaneous nodules in Bali cattle often presents a diagnostic challenge, particularly in distinguishing between endemic parasitic infestations and high-priority transboundary viral diseases. In this case, the large nodular lesions initially necessitated a thorough differential diagnosis involving Foot-and-Mouth Disease (FMD) and Lumpy Skin Disease (LSD).

The clinical investigation in Wulukubun Village underscores the critical importance of differential diagnosis in managing nodular skin diseases in border regions. Although the initial physical presentation raised concerns regarding Lumpy Skin Disease (LSD), the laboratory results effectively ruled out *Capripoxvirus* and FMDV, confirming a case of bovine demodicosis. The 33.3% herd prevalence observed in this smallholder farm is significantly higher than the general prevalence of 4.9% reported in broader cross-sectional studies (4), likely due to the closed-herd communal housing system which facilitated prolonged physical contact between the index and secondary cases.

The progression of lesions over two months reflects the chronic nature of *Demodex* sp. infestations. The localized distribution on the face, neck, and abdomen as primary predilection sites in Bali cattle (1). Furthermore, the variation in nodule diameter (2–8 cm) and the "dollar plaque" appearance in the secondary case are consistent with the morphological descriptions of demodicosis, which often starts as small circumscribed papules before progressing into larger, indurated nodules as the mites multiply within the hair follicles (1).

A key diagnostic differentiator in this case was the systemic stability of the affected cattle. Unlike LSD, which typically presents with high fever, lymphadenopathy, and "sit-fast" necrotic cores (2), the cattle in Keerom maintained normal appetite and rectal temperatures. This lack of systemic involvement, despite extensive skin thickening and alopecia, is highly characteristic of demodicosis. The statistically significant variation in infestation sites reported in literature—specifically the high prevalence in the shoulder and neck regions (4)—further supports the field observations where lesions were concentrated in the anterior portion of the animal's body.

The environmental conditions in Keerom, characterized by high tropical humidity and biting insects, may have acted as predisposing factors. While the laboratory results confirmed *Demodex* sp. as the primary etiologic agent, the role of mechanical vectors or environmental stress in exacerbating cutaneous manifestations in Bali cattle warrants further longitudinal surveillance. These findings demonstrate that even in high-risk zones for transboundary diseases, endemic parasitic conditions like demodicosis can manifest with high clinical severity, necessitating robust laboratory-backed surveillance to prevent unnecessary economic alarm.

The therapeutic use of Ivermectin on January 14, 2025, followed by a booster on January 28, was essential to interrupt the *Demodex* sp. life cycle (1). Beyond clinical recovery, providing CIE on National Strategic Contagious Diseases (PHMS) is a vital surveillance component in the Keerom border region. As emphasized by WOAH (2, 3), rapid clinical differentiation and strict biosecurity, including isolation, are crucial to safeguard against transboundary pathogens like LSD and FMD.

**Conclusion**
Nodular skin lesions observed in Bali cattle in Wulukubun Village, Skanto Subdistrict, Keerom District, Papua Province, Indonesia, were attributed to infestation by *Demodex* spp. Affected animals exhibited clinical signs

characterized by extensive skin thickening and localized alopecia surrounding the nodular lesions, particularly on the facial region, neck, and abdomen.

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| Diagnostic Tests | Sample Type | Result |
|---|---|---|
| RT-PCR FMDV | nasopharyngeal swab | Negative (2/2) |
| RT-PCR LSDV | whole blood with EDTA | Negative (2/2) |
| | skin scraping | Negative (1/1) |
| ELISA LSD antibody detection | serum | Seronegative (2/2) |
| Ectoparasite identification | skin scraping | Positive *Demodex sp.* (2/2) |

Table 1. Diagnostic Tests Results on Cattle Samples in Wulukubun Village, Skanto Subdistrict, Keerom District, Papua Province, 2025

**Keywords:** Demodex sp., Papua, Cattle, Nodule, LSD.

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